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AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY WITH INDEXES



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Typical Report Citation and Abstract

- ❶ 19970001126 NASA Langley Research Center, Hampton, VA USA
- ❷ **Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes**
- ❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA;
- ❹ Mar. 1996; 130p; In English
- ❺ Contract(s)/Grant(s): RTOP 505-68-70-04
- ❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
- ❼ To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10° to 50°, and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65° swept forebody serrations tended to roll together, while vortices from 40° swept serrations were more effective in generating additional lift caused by their more independent nature.
- ❽ Author
- ❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

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AERONAUTICAL ENGINEERING

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SEPTEMBER 4, 1998

01 AERONAUTICS

19980203590 Nebraska Univ., Aviation Inst., Omaha, NE USA

Journal of Air Transportation World Wide, Volume 3

Bowen, Brent D., Editor, Nebraska Univ., USA; 1998; ISSN 1093-8826; 108p; In English; Also announced as 19980203591 through 19980203597

Contract(s)/Grant(s): NGT5-40037

Report No.(s): NASA/CR-1998-208347; NAS 1.26:208347; Copyright Waived (NASA); Avail: CASI; A06, Hardcopy; A02, Microfiche

The Journal of Air Transportation World Wide's (JATWW) mission is to provide the global community immediate key resource information in all areas of air transportation. Our goal is to be recognized as the preeminent scholarly journal in the aeronautical aspects of transportation. As an international and interdisciplinary journal, the JATWW will provide a forum for peer-reviewed articles in all areas of aviation and space transportation research, policy, theory, case study, practice, and issues. While maintaining a broad scope, a focal point of the journal will be in the area of aviation administration and policy.

Derived from text

Air Transportation; Civil Aviation; Policies

19980203985 Advisory Group for Aerospace Research and Development, Fluid Dynamics Panel, Neuilly-Sur-Seine, France

Advanced Aerodynamic Measurement Technology *Technologies Avancees de Mesure Aerodynamique*

Advanced Aerodynamic Measurement Technology; May 1998; 420p; In English; In French; 81st; Fluid Dynamics Panel Symposium, 22-25 Sep. 1997, Seattle, WA, USA; Also announced as 19980203986 through 19980204020; Original contains color illustrations

Report No.(s): AGARD-CP-601; ISBN 92-836-0056-8; Copyright Waived; Avail: CASI; A18, Hardcopy; A04, Microfiche

The papers prepared for the AGARD Fluid Dynamics Panel (FDP) Symposium, "Advanced Aerodynamic Measurement Technology" are contained in this report. In addition, a Technical Evaluator's Report aimed at assessing the success of the Symposium in meeting its objectives, and an edited transcript of the General Discussion held at the end of the Symposium are also included. Measurement techniques were presented for flows from subsonic to hypersonic Mach numbers and environments from cryogenic to high-enthalpy reacting flows. Papers presented during the sessions addressed the following subjects: Particle Image Velocimetry; Doppler Global Velocimetry; Molecular Diagnostic Techniques; Holographic Interferometry; Skin Friction Measurements; Pressure Sensitive Paints; and Balance and Model Deformation Measurements.

Author

Aerodynamics; Particle Image Velocimetry; Skin Friction; Mechanical Measurement; Flow Visualization; Conferences; Measuring Instruments; Wind Velocity Measurement; Flow Measurement; Wind Tunnels; Flow Characteristics

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

19980203477 Naval Postgraduate School, Monterey, CA USA

Design of Digital Control Algorithms for Unmanned Air Vehicles

Froncillo, Steven J., Naval Postgraduate School, USA; Mar. 1998; 100p; In English

Report No.(s): AD-A344726; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

Recent advances in the design of high performance aircraft, such as fly by wire controls, complex autopilot systems, and unstable platforms for greater maneuverability, are all possible due to the use of digital control systems. With the aid of modem

control tools and techniques based on state-space methods, the aerospace engineer has the ability to design a dynamic aircraft model, verify its accuracy, and design and implement the controller within a matter of a few months. This work examines the digital control design process utilizing a Rapid Prototyping System developed at the Naval Postgraduate School. The entire design process is presented, from design of the controller to implementation and flight test on an Unmanned Air Vehicle (UAV).

DTIC

Design Analysis; Algorithms; Aircraft Design; Aircraft Models; Digital Systems; Control Systems Design

19980203544 Lockheed Martin Engineering and Sciences Co., Hampton, VA USA

Surface Modeling and Grid Generation of Orbital Sciences X34 Vehicle, Phase 1

Alter, Stephen J., Lockheed Martin Engineering and Sciences Co., USA; Nov. 1997; 118p; In English

Contract(s)/Grant(s): NAS1-96014; RTOP 242-80-01-01

Report No.(s): NASA/CR-97-206243; NAS 1.26:206243; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The surface modeling and grid generation requirements, motivations, and methods used to develop Computational Fluid Dynamic volume grids for the X34-Phase 1 are presented. The requirements set forth by the Aerothermodynamics Branch at the NASA Langley Research Center serve as the basis for the final techniques used in the construction of all volume grids, including grids for parametric studies of the X34. The Integrated Computer Engineering and Manufacturing code for Computational Fluid Dynamics (ICEM/CFD), the Grid Generation code (GRIDGEN), the Three-Dimensional Multi-block Advanced Grid Generation System (3DMAGGS) code, and Volume Grid Manipulator (VGM) code are used to enable the necessary surface modeling, surface grid generation, volume grid generation, and grid alterations, respectively. All volume grids generated for the X34, as outlined in this paper, were used for CFD simulations within the Aerothermodynamics Branch.

Author

Computational Fluid Dynamics; Grid Generation (Mathematics); Surfaces; Orbitals; X-34 ReUSABLE Launch Vehicle; Three Dimensional Models

19980203580 Instituto Nacional de Tecnica Aeroespacial, Div. de Aerodinamica, Madrid, Spain

Hybrid Grid: VISC GG2D VORTICE: Bidimensional Grid Improvement, 1 Mallador Hibrido: VISC GGSD (Version 01). VORTICE: Mejora Mallador Bidimensional

Sanchez-Martinez, Francisco J., Instituto Nacional de Tecnica Aeroespacial, Spain; Oct. 31, 1997; 34p; In Spanish

Report No.(s): AT/TNO/4510/007/INTA/97; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

In this document is presented the generation of a hybrid grid, developed from a unstructured grid previously designed and implemented at INTA Aerodynamics Division. In the first section is given a justification of the grid use in the calculation of internal and external flows. Afterwards are explained the way follows for the selection of the method and the structure of the developed code.

Author

Unstructured Grids (Mathematics); Internal Flow; Computer Programs

19980203842 Massachusetts Inst. of Tech., Center for Aerodynamic Studies, Cambridge, MA USA

Unsteady Loads on Compressor and Turbine Blade Induced by Passage of a Density Wake Final Report, 1 Jul. 1994 - 31 Dec. 1997

Ramer, B., Massachusetts Inst. of Tech., USA; Wijesinghe, S., Massachusetts Inst. of Tech., USA; Tam, C., Massachusetts Inst. of Tech., USA; Covert, E., Massachusetts Inst. of Tech., USA; Mar. 16, 1997; 47p; In English

Contract(s)/Grant(s): F49620-94-1-0202

Report No.(s): AD-A343829; R-99-003; AFRL-SR-BL-TR-98-0437; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The object of the research funded under this grant is to study the unsteady aerodynamic forces and moments induced on cascade blades by a convected density gradient that is more or less normal to the flow path. Previous investigators have considered the effect of a variety of convected disturbances on cascade, compressor, and turbine performance. However, we believe this is the first investigation to focus on the production of unsteady loads associated with this process. The size and frequency content of these loads, when combined with other loads as fan, compressor and turbine blades have the potential to reduce the blade's high cycle fatigue life.

DTIC

Aerodynamic Forces; Compressor Blades; Fan Blades; Turbine Blades

19980203926 Stanford Univ., Mechanical Engineering, Stanford, CA USA

Large Eddy Simulation of Turbulent Flow Over an Airfoil Using Both Structured and Unstructured Grids *Final Report, 1 Aug. 1996 - 30 Nov. 1997*

Moin, Parviz, Stanford Univ., USA; Apr. 1998; 48p; In English

Contract(s)/Grant(s): F49520-96-1-0420

Report No.(s): AD-A343850; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes the application of Large Eddy Simulations (LES) to turbulent flow over an airfoil. Two different approaches have been used, a second-order finite-difference solver on structured grid and a finite-element solver on unstructured grid. Results are presented for the flow around a NACA 4412 airfoil at maximum lift. The diversity of flow characteristics encountered in this flow include laminar, transitional and turbulent boundary layers, flow separation, unstable free shear layers and a wake. While Reynolds-averaged Navier-Stokes simulations (RANS) have had some success when tuned to flows dominated by one such flow characteristic, this variety of flow features taxes the presently available RANS models and presents an excellent opportunity to validate the utility of the dynamic SGS model for LES. Work has also been conducted on high order methods, both for the unstructured and the structured approach.

DTIC

Turbulent Boundary Layer; Turbulent Flow; Boundary Layer Separation; Computational Grids; Laminar Boundary Layer; Large Eddy Simulation

19980203997 Boeing Commercial Airplane Co., Aerodynamics Lab., Seattle, WA USA

Airplane Flow-Field Measurements and the Flying Strut

Crowder, J. P., Boeing Commercial Airplane Co., USA; May 1998; 8p; In English; Also announced as 19980203985; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The prospect for useful measurements of airplane flow-field properties are reviewed. Early experience in flow-field measurements at Boeing is described, as are the requirements for quantitative flow-field surveys in industrial wind tunnels. Recent examples of quantitative flow-field measurements of lift and drag distributions in subsonic and transonic wind tunnels are presented. A new invention, called the Flying Strut, is introduced as a practical system for flow-field surveys in large wind tunnels and in flight.

Author

Aircraft Design; Transonic Wind Tunnels; Subsonic Wind Tunnels; Flow Distribution; Struts

19980204006 NASA Ames Research Center, Moffett Field, CA USA

Development of High Speed Interferometry Imaging and Analysis Techniques for Compressible Dynamic Stall

Chandrasekhara, M. S., Naval Postgraduate School, USA; Carr, L. W., NASA Ames Research Center, USA; Wilder, M. C., MCAT Inst., USA; May 1998; 12p; In English; Also announced as 19980203985

Contract(s)/Grant(s): ARO-MIPR-96-7; AF-AFOSR-MIPR-0004-92; AF-AFOSR-ISSA-0067-89; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

The development of a high-speed, phase-locked, realtime, point diffraction interferometry system for quantitative imaging unsteady separated flows is described. The system enables recording of up to 224 interferograms of the dynamic stall flow over an oscillating airfoil using a drum camera at rates of up to 40 KHz controlled by custom designed electronic interlocking circuitry. Several thousand interferograms of the flow have been obtained using this system. A comprehensive image analysis package has been developed for automatic processing of this large number of images. The software has been specifically tuned to address the special characteristics of airfoil flow interferograms. Examples of images obtained using the standard and the high-speed interferometry techniques are presented along with a demonstration of the image processing routine's ability to resolve the fine details present in these images.

Author

Aerodynamic Stalling; Imaging Techniques; Interferometry; Image Processing; Airfoils

19980204014 Tsentralni Aerogidrodinamicheskii Inst., Zhukovsky, Russia

Study Result for the Application of Teo-Component PSP Technology to Aerodynamic Experiment

Bykov, A., Tsentralni Aerogidrodinamicheskii Inst., Russia; Fonov, S., Tsentralni Aerogidrodinamicheskii Inst., Russia; Mosharov, V., Tsentralni Aerogidrodinamicheskii Inst., Russia; Orlov, A., Tsentralni Aerogidrodinamicheskii Inst., Russia; Pesetsky, V., Tsentralni Aerogidrodinamicheskii Inst., Russia; Radchenko, V., Tsentralni Aerogidrodinamicheskii Inst., Russia; May 1998; 8p; In English; Also announced as 19980203985

Contract(s)/Grant(s): ARO Proj. N36439-EG; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The increase in the PSP measurement accuracy in wind tunnels is related first of all to the application of the two-component PSP technology. Besides the active luminophor the luminescence of which depends on pressure, the two-component PSP formulation also contains an additional luminophor. The simultaneous measurement of the luminescence intensities of the active luminophor and the additional luminophor makes it possible to avoid numerous difficulties characteristic of the one-component PSP technology. Consideration is given to some processes affecting the two-component PSP measurement accuracy. The transonic wind tunnel investigations of the two-component PSP are presented. Also, the first results of investigating the possibility of applying PSP pressure measurements to the helicopter rotor blade using the two-component PSP are given.

Author

Aerodynamics; Pressure Measurement; Aircraft

19980204015 Office National d'Etudes et de Recherches Aerospatiales, Modane, France

The Two-Component PSP Investigation on a Civil Aircraft Model in S2MA Wind Tunnel

Lyonnet, Marianne, Office National d'Etudes et de Recherches Aerospatiales, France; Deleglise, Bruno, Office National d'Etudes et de Recherches Aerospatiales, France; Grenat, Gerard, Office National d'Etudes et de Recherches Aerospatiales, France; Bykov, A., Tsentralni Aerogidrodinamicheskii Inst., Russia; Mosharov, V., Tsentralni Aerogidrodinamicheskii Inst., Russia; Orlov, A., Tsentralni Aerogidrodinamicheskii Inst., Russia; Fonov, S., Tsentralni Aerogidrodinamicheskii Inst., Russia; May 1998; 8p; In English; Also announced as 19980203985; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Pressure sensitive paint (PSP) is a technology of major interest to wind tunnel operators. As part of the cooperation programme between ONERA and TsAGI an evaluation test of the optical pressure measurement system developed by TsAGI was performed in the transonic test section of the S2MA wind tunnel at the Modane centre. The tests were carried out on an Airbus model loaned by Aerospatiale. The left wing was instrumented with 240 pressure taps, the right wing was covered by a two-component PSP, developed by the Russian firm OPTROD. Experimental set-up, characteristics of the two component paint and data processing are described. Comparisons between results from conventional and PSP measurements are presented, and the effects of incidence, Mach number, pressure and temperature are discussed.

Author

Aircraft Models; Civil Aviation; Optical Measurement; Pressure Distribution; Pressure Measurement

19980204016 NASA Ames Research Center, Moffett Field, CA USA

Low-Speed Flow Studies Using the Pressure Sensitive Paint Technique

Brown, O. C., Stanford Univ., USA; Mehta, R. D., NASA Ames Research Center, USA; Cantwell, B. J., Stanford Univ., USA; May 1998; 14p; In English; Also announced as 19980203985; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Optical pressure measurements have been made on a NACA 0012 airfoil coated with Pressure Sensitive Paint (PSP) at very low flow speeds (less than 50 m/s). Angle of attack was limited to 5 deg. for most measurements. Effects of temperature gradients and mis-registration errors on PSP response have been established and minimized, by reducing measurement error caused by these effects. PSP sensitivity has been enhanced. Acceptable aerodynamic data at flow speeds down to 20 m/s have been obtained and valid pressure paint response was observed down to 10 m/s. Measurement errors (in terms of pressure and pressure coefficient) using PSP with pressure taps as a reference are provided for the range of flow speeds from 50 m/s to 10 m/s.

Author

Aerodynamics; Paints; Coatings; Airfoils; Pressure Measurement; Temperature Effects

19980204019 NASA Langley Research Center, Hampton, VA USA

Model Deformation Measurements at NASA Langley Research Center

Burner, A. W., NASA Langley Research Center, USA; May 1998; 10p; In English; Also announced as 19980203985; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Only recently have large amounts of model deformation data been acquired in NASA wind tunnels. This acquisition of model deformation data was made possible by the development of an automated video photogrammetric system to measure the changes in wing twist and bending under aerodynamic load. The measurement technique is based upon a single view photogrammetric determination of two dimensional coordinates of wing targets with a fixed third dimensional coordinate, namely the spanwise location. A major consideration in the development of the measurement system was that use of the technique must not appreciably reduce wind tunnel productivity. The measurement technique has been used successfully for a number of tests at four large production wind tunnels at NASA and a dedicated system is nearing completion for a fifth facility. These facilities are the National Transonic Facility, the Transonic Dynamics Tunnel, and the Unitary Plan Wind Tunnel at NASA Langley, and the 12-FT Pressure

Tunnel at NASA Ames. A dedicated system for the Langley 16-Foot Transonic Tunnel is scheduled to be used for the first time for a test in September. The advantages, limitations, and strategy of the technique as currently used in NASA wind tunnels are presented. Model deformation data are presented which illustrate the value of these measurements. Plans for further enhancements to the technique are presented.

Author

Aerodynamic Loads; Deformation; Aircraft Models; Wind Tunnels

19980204020 Case Western Reserve Univ., School of Engineering, Cleveland, OH USA

MEMS Applications in Aerodynamic Measurement Technology

Reshotko, E., Case Western Reserve Univ., USA; Mehregany, M., Case Western Reserve Univ., USA; Bang, C., Advanced Micro-machines, Inc., USA; May 1998; 10p; In English; Also announced as 19980203985

Contract(s)/Grant(s): F49620-96-I-0482; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Microelectromechanical systems (MEMS) embodies the integration of sensors, actuators, and electronics on a single substrate using integrated circuit fabrication techniques and compatible bulk and surface micromachining processes. Silicon and its derivatives form the material base for the MEMS technology. MEMS devices, including microsensors and microactuators, are attractive because they can be made small (characteristic dimension about 100 microns), be produced in large numbers with uniform performance, include electronics for high performance and sophisticated functionality, and be inexpensive. For aerodynamic measurements, it is preferred that sensors be small so as to approximate measurement at a point, and in fact, MEMS pressure sensors, wall shear-stress sensors, heat flux sensors and micromachined hot wires are nearing application. For the envisioned application to wind tunnel models, MEMS sensors can be placed on the surface or in very shallow grooves. MEMS devices have often been fabricated on stiff, flat silicon substrates, about 0.5 mm thick, and therefore were not easily mounted on curved surfaces. However, flexible substrates are now available and heat-flux sensor arrays have been wrapped around a curved turbine blade. Electrical leads can also be built into the flexible substrate. Thus MEMS instrumented wind tunnel models do not require deep spanwise grooves for tubes and leads that compromise the strength of conventionally instrumented models. With MEMS, even the electrical leads can potentially be eliminated if telemetry of the signals to an appropriate receiver can be implemented. While semiconductor silicon is well known for its electronic properties, it is also an excellent mechanical material for MEMS applications. However, silicon electronics are limited to operations below about 200 C, and silicon's mechanical properties start to diminish above 400 C. In recent years, silicon carbide (SiC) has emerged as the leading material candidate for applications in high temperature environments and can be used for high-temperature MEMS applications. With SiC, diodes and more complex electronics have been shown to operate to about 600 C, while the mechanical properties of SiC are maintained to much higher temperatures. Even when MEMS devices show benefits in the laboratory, there are many packaging challenges for any aeronautics application. Incorporating MEMS into these applications requires new approaches to packaging that goes beyond traditional integrated circuit (IC) packaging technologies. MEMS must interact mechanically, as well as electrically with their environment, making most traditional chip packaging and mounting techniques inadequate. Wind tunnels operate over wide temperature ranges in an environment that is far from being a 'clean-room.' In flight, aircraft are exposed to natural elements (e.g. rain, sun, ice, insects and dirt) and operational interferences (e.g. cleaning and deicing fluids, and maintenance crews). In propulsion systems applications, MEMS devices will have to operate in environments containing gases with very high temperatures, abrasive particles and combustion products. Hence deployment and packaging that maintains the integrity of the MEMS system is crucial. This paper presents an overview of MEMS fabrication and materials, descriptions of available sensors with more details on those being developed in our laboratories, and a discussion of sensor deployment options for wind tunnel and flight applications.

Author

Aerodynamics; Mechanical Properties; Micromachining; Semiconductors (Materials); Wind Tunnel Tests; Turbine Blades

19980204840 Rensselaer Polytechnic Inst., Troy, NY USA

Augmentation of Rotorcraft Technology Center Final Report, Jun. 1994 - Oct. 1996

Bauchau, Olivier A., Rensselaer Polytechnic Inst., USA; Lemnios, Andrew, Rensselaer Polytechnic Inst., USA; Jan. 27, 1997; 5p; In English

Contract(s)/Grant(s): DAAH04-94-G-0073

Report No.(s): AD-A344153; A10546; ARO-32321.2-EG-RW; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This project conducted research on tasks related to rotorcraft aerodynamics, dynamics, materials, and structures as approved

by the Army Research Office. A total of seven fundamental and multidisciplinary research tasks in rotorcraft materials, structural dynamics, unsteady aerodynamics and aeroelasticity were pursued, each of them highly interactive with at least one of the other tasks in this project.

DTIC

Aerodynamic Characteristics; Rotary Wing Aircraft; Augmentation; Dynamic Structural Analysis; Aeroelasticity

19980204999 Ohio State Univ., Dept. of Mechanical Engineering, Columbus, OH USA

Vortex Surface Collisions Final Report

Conlisk, A. T., Ohio State Univ., USA; Komerath, N. M., Georgia Inst. of Tech., USA; Mar. 1998; 293p; In English

Contract(s)/Grant(s): DAAH04-93-G-0048

Report No.(s): AD-A344207; Rept-760601/727272; ARO-30707.4-EG; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

Many flows of practical interest contain discrete vortices. These include tornadoes, propeller wakes, and flows over swept wings and missile forebodies. The encounter of a vortex with a solid body is always a complex event involving very large gradients of pressure and velocity. We consider the problem in which a rotor-tip vortex collides with a helicopter airframe. The primary objective of this work is to describe both experimentally and computationally the interaction when the vortex "collides" directly with the airframe in the sense that at some point the flow in the vortex core must be altered to accommodate the presence of the airframe. The pressure field caused by the collision is also described. The dominant physics of the collision process may be described by inviscid flow theory and it is the component directed along the tip-vortex axis, termed the axial flow, which is the major cause of the collision.

DTIC

Vortices; Axial Flow; Pressure Gradients; Aircraft Structures; Flow Visualization; Vortex Shedding; Unsteady Flow; Inviscid Flow; Boundary Layer Flow; Three Dimensional Flow; Interactional Aerodynamics

19980206350 NASA Lewis Research Center, Cleveland, OH USA

Experimental Investigation of Boundary Layer Behavior in a Simulated Low Pressure Turbine

Sohn, Ki-Hyeon, Toledo Univ., USA; Shyne, Rickey J., NASA Lewis Research Center, USA; DeWitt, Kenneth J., Toledo Univ., USA; Jun. 1998; 11p; In English; Turbo Expo 1998, 2-5 Jun. 1998, Stockholm, Sweden; Sponsored by American Society of Mechanical Engineers, USA

Contract(s)/Grant(s): RTOP 523-26-33

Report No.(s): NASA/TM-1998-207921; E-11204; NAS 1.15:207921; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A detailed investigation of the flow physics occurring on the suction side of a simulated Low Pressure Turbine (LPT) blade was performed. A contoured upper wall was designed to simulate the pressure distribution of an actual LPT blade onto a flat plate. The experiments were carried out at Reynolds numbers of 100,000 and 250,000 with three levels of freestream turbulence. The main emphasis in this paper is placed on flow field surveys performed at a Reynolds number of 100,000 with levels of freestream turbulence ranging from 0.8% to 3%. Smoke-wire flow visualization data was used to confirm that the boundary layer was separated and formed a bubble. The transition process over the separated flow region is observed to be similar to a laminar free shear layer flow with the formation of a large coherent eddy structure. For each condition, the locations defining the separation bubble were determined by careful examination of pressure and mean velocity profile data. Transition onset location and length determined from intermittency profiles decrease as freestream turbulence levels increase. Additionally, the length and height of the laminar separation bubbles were observed to be inversely proportional to the levels of freestream turbulence.

Author

Boundary Layer Transition; Turbines; Free Flow; Flow Visualization; Turbulent Boundary Layer; Boundary Layer Separation; Turbine Blades; Turbulent Flow; Laminar Flow; Flow Characteristics

AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

19980203494 General Accounting Office, National Security and International Affairs Div., Washington, DC USA

Report to the Honorable John McCain, US Senate. Intratheater Airlift: Information on the Air Force's C-130 Aircraft

Apr. 1998; 36p; In English

Report No.(s): AD-A343299; GAO/NSIAD-98-108; B-274598; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The current C-130 fleet is comprised of 12 different variants and the missions vary with each variant. While most of the current fleet is comprised of combat delivery aircraft, many of the C-130 variants perform specialized missions. The combat delivery C-130 fleet, designated as C-130Es and C-130Hs, is used in a wide variety of wartime and peacetime missions. In wartime, the C-130 combat delivery aircraft primarily performs the intratheater portion of the airlift mission, leaving the long-range intratheater transport mission to larger aircraft such as the C-5 and C-17. These C-130s primarily provide rapid transportation of personnel or cargo for delivery by parachute to a designated drop zone, or by landing at austere locations within the conflict area. These aircraft are also the primary aeromedical evacuation aircraft in a conflict. In peacetime, the combat delivery C-130 is used for training flights, regularly scheduled channel operations, and special assignment missions. It is also used in fire fighting and humanitarian relief missions. For example, it has been used to airlift heavy equipment into remote areas of other countries to build airports and roads, and transport local goods. In addition to the missions performed by the basic combat delivery C-130 aircraft, 11 other variants perform specialized missions. These missions include (1) weather reconnaissance, performed by the WC-130 aircraft; (2) special communication missions, performed by the EC-130 aircraft; and (3) search and rescue, performed by the HC-130 aircraft. The 12 different C-130 models that are currently in the fleet and their respective missions are summarized in table 1.

DTIC

Transport Aircraft; Congressional Reports; Combat; Evacuating (Transportation); Fighter Aircraft; Rescue Operations; Transportation

19980203531 Sandia National Labs., Albuquerque, NM USA

Overview of composite projects at the FAA Airworthiness Assurance Validation Center

Shurtleff, W. W., Sandia National Labs., USA; Roach, D. P., Sandia National Labs., USA; Valley, M. T., Sandia National Labs., USA; 1997; 11p; In English; 11th; Composite Materials, 14 - 18 Jul. 1997, Gold Coast, Australia

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-96-2666C; CONF-970735-1; DE97-002544; No Copyright; Avail: Issuing Activity (Nat'l Technical Information Service (NTIS)), Hardcopy, Microfiche

The Airworthiness Assurance NDI Validation Center (AANC) was established by the Federal Aviation Administration (FAA) William J. Hughes Technical Center at Sandia National Laboratories in 1991 to support nondestructive inspection (NDI) technology development and assessment. The evaluations are done using a variety of characterized test specimens and test beds including entire transport and commuter aircraft. Although the initial work at the Center concentrated on metallic structure, the FAA has more recently expanded the AANC's charter to include projects directed at composite repair and inspection. The three projects briefly described in this paper are: (1) the validation and technology transfer of a thermographic techniques for composite inspection, (2) the development of generic composite laminate and honeycomb calibration reference standards, and (3) the certification of the use of boron epoxy doubler on a Lockheed L-1011.

DOE

Aircraft Reliability; Commuter Aircraft; Honeycomb Structures; Transport Aircraft

19980203593 Maryland Univ., Princess Anne, MD USA

Human Factors: Tenerife Revisited

McCreary, John, Maryland Univ., USA; Pollard, Michael, Maryland Univ., USA; Stevenson, Kenneth, Maryland Univ., USA; Wilson, Marc B., Maryland Univ., USA; Journal of Air Transportation World Wide; 1998; ISSN 1093-8826; Volume 3, No. 1, pp. 23-31; In English; Also announced as 19980203590; Copyright Waived (NASA); Avail: CASI; A02, Hardcopy; A02, Microfiche

This case study is a human factors analysis of the aircraft collision which occurred at the Los Rodeos airport in Tenerife, on the Canary Islands. The collision between two 747 jumbo jets cost the lives of 583 people. This collision is an example of how large scale disasters result from errors made by people in crucial circumstances and illustrates the potentially devastating consequences of ineffective human and organizational behavior. This paper focuses on three areas that were the major contributing fac-

tors in the accident: stress, small group communication under stress, and small group dynamics. An analysis of the accident in each of these areas determined what measures can be taken to prevent catastrophes of this nature from reoccurring (reengineering for improvement).

Author

Airports; Canary Islands; Collisions; Disasters; Human Behavior; Human Factors Engineering; Aircraft Accident Investigation; Air Transportation

19980203595 Cranfield Univ., Bedford, UK

Air Transport Liberalization in Europe: The Progress So Far

Morrell, Peter, Cranfield Univ., UK; Journal of Air Transportation World Wide; 1998; ISSN 1093-8826; Volume 3, No. 1, pp. 41-60; In English; Also announced as 19980203590; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A02, Microfiche

In April 1997, the final phase of a series of measures were implemented which were aimed at liberalizing air transport within the European Union (EU). These measures were introduced on a phased basis, the first package coming into force in 1988, the second in 1990, and the most significant third package in 1993 (which included a delayed 1997 lifting of cabotage protection). These applied on a multilateral basis within the European Community (with some exclusion clauses), and followed progress towards liberalization on a bilateral basis between 1985 and 1988, most notably on routes between the UK and a number of EU countries. This paper examines the progress so far in the achievement of liberalization and greater competition within Europe. It is based on extensive research carried out by the author and a team from Cranfield University over 1995 and 1996. This included desk research, a survey of and interviews with EU airlines and aviation authorities, and five more-detailed airline case studies. This has been updated by the author to take into account more recent developments, especially regarding new entrant airlines. Some of the expectations following the introduction of EU liberalization have not been met: there have been few serious challenges to the flag carrier duopolies, there has been a consolidation of the major airlines in their home markets, and business and fully flexible fares have continued to climb. However, many of the airlines' strategic changes were more in response to developments in global rather than EU markets. On the other hand, consumers have benefited from greater competition in promotional fares, and more dynamic pricing tactics overall have led to higher intra-EU traffic growth in the early 1990s than would have been the case without liberalization. There was also a substantial growth in the number of EU cities served by non-stop services, and some encouraging trends from new entrant airlines in some countries. On balance, it is argued that the net result has been disappointing; but this is hardly surprising given the timing of the final stage of liberalization in the middle of an economic recession, the concern of the larger airlines with more global events, and the time needed to change some of the more deep-seated structural barriers, such as airport slot availability, input market monopolies and state aids.

Author

Air Transportation; Airline Operations; Progress; Competition; Market Research; Air Traffic

19980203641 Illinois Univ., Urbana-Champaign, IL USA

Error Types and Related Error Detection Processes in the Aviation Domain

Alexander, Heather M., Illinois Univ., USA; May 07, 1998; 75p; In English

Report No.(s): AD-A343598; Rept-98-008; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Human error has been identified as a contributing factor in 75-80% of all aviation accidents. To date, most efforts to improve flight safety have focused on error prevention. A different approach that has received less attention is to avoid the negative consequences of erroneous actions and assessments by supporting their timely detection. In this study, aviation incidents were analyzed in terms of the type of error involved (errors of omission and commission; slips, lapses, and mistakes), the performance level at which the error occurred (skill-, rule-, or knowledge-based performance), and the relation between error types and error detection processes that prevented these incidents from turning into accidents. The majority of reported errors were lapses, i.e., failures to perform a required action, and mistakes, i.e., errors in the formation of an intention. Relatively few slips, i.e., inappropriate executions of intended actions, were reported. Slips appear to be detected and corrected by the pilot before they result in an unsafe situation that is worth reporting. Lapses and mistakes, on the other hand, are more difficult for the pilot committing the error to detect and, in most cases, required intervention by air traffic control. A large percentage of lapses resulted from inattention, either due to some distraction in the cockpit or due to multiple competing demands. Mistakes, on the other hand, frequently occurred as a consequence of some misunderstanding between pilots and air traffic controllers concerning clearances and intentions. Most lapses were detected incidentally based on routine checks of aircraft settings and performance, whereas errors of commission, which include both mistakes and slips, were detected equally often based on monitoring for the immediate outcome of an action.

and by routine checks. These findings indicate the need for more effective support of error detection, particularly in the case of lapses and mistakes.

DTIC

Prevention; Pilot Error; Human Performance; Flight Safety; Aircraft Accidents

19980203657 National Transportation Safety Board, Washington, DC USA

Aircraft Accident Report: Uncontained Engine Failure Delta Air Lines Flight 1288, McDonnell Douglas MD-88, N927DA, Pensacola, Florida, July 6, 1996

Jan. 13, 1998; 136p; In English

Report No.(s): AD-A343392; NTSB/AAR-98/01; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report explains the accident involving Delta Air Lines flight 1288, an MD-88, which experienced and uncontained engine failure during the initial part of its takeoff roll at Pensacola Regional Airport in Pensacola, Florida, on July 6, 1996. Safety issues in the report include the limitations of the blue etch anodize process, manufacturing defects, standards for the fluorescent penetrant inspection process, the performance of nondestructive testing, the use of alarm systems for emergency situations, and instructions regarding emergency exits. Safety recommendations concerning these issues were made to the Federal Aviation Administration.

DTIC

Aircraft Accident Investigation; Emergencies; Engine Failure; Safety; Accident Investigation

19980205675 Department of Transportation, Bureau of Statistics, Washington, DC USA

Air Carrier Reporting Punctuality Assessment. Accounting and Report Directive

May 26, 1998; 14p; In English

Report No.(s): PB98-145709; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report contains eight tables showing the timeliness factor for each air carrier's recurrent reporting. An average of days late per report is computed for all reports required to be filed during the specific six-month period. The computation considers only the timeliness of filing, and does not relate to the validity of data contained in the submissions. The multiple tables permit comparison among carriers with similar operations or revenue levels.

NTIS

Air Transportation; Tables (Data); Revenue; Accounting

19980206343 Armstrong Lab., Biodynamics and Biocommunications Div., Wright-Patterson AFB, OH USA

+GZ Impact Tests of the Large JPATS Manikin in a Simulated Martin-Baker Ejection Seat Interim Report, Jul - Oct. 1997

Buhrman, John R., Armstrong Lab., USA; Oct. 1997; 179p; In English

Contract(s)/Grant(s): Proj-7184

Report No.(s): AD-A344944; AL/CF-TR-1997-0173; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

One Large Joint Primary Aircraft Training System (JPATS) manikin and one GARD CG manikin were exposed to a series of short-duration z-axis acceleration pulses on the Armstrong Laboratory Vertical Deceleration Tower. The manikins were placed in a test fixture intended to simulate the Martin-Baker MKUS16LA ejection seat. Biodynamic response data were collected in order to evaluate the dynamic effect of the manikins on the seat during a simulated ejection. The results demonstrated the presence of large lap belt loads and excessive hip and knee displacements in tests with the Large JPATS manikin. It was determined that these phenomena were due to several factors which included the pre-impact positioning of the manikin's thighs above the seat pan, the fabric of the flight suit, the length of the seat pan, and the center of mass of the manikin's lower torso. Modifications which altered the weight and center of mass of the Large JPATS manikin's legs and extended the seat pan length were successful in reducing the loads and motions.

DTIC

Impact Tests; Ejection Seats; Biodynamics; Center of Mass

AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

19980203347 Carnegie-Mellon Univ., Pittsburgh, PA USA

Assessment of CORBA and POSIX.21 Designs for FAA En Route Resectorization

Meyers, B. Craig, Carnegie-Mellon Univ., USA; Plakosh, Daniel R., Carnegie-Mellon Univ., USA; Place, Patrick R. H., Carnegie-Mellon Univ., USA; Klein, Mark, Carnegie-Mellon Univ., USA; Kazman, Rick, Carnegie-Mellon Univ., USA; Apr. 1998; 252p; In English

Report No.(s): AD-A343704; CMU/SEI-98-SR-002; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

Modernizing the En Route system presents major acquisition issues to the Federal Aviation Administration (FAA). At the present time, efforts are underway to upgrade the En Route system, primarily focusing on the host computer system. Some of the major issues include the following: (1) What are the consequences of using different technologies and products? (2) How can one assess the use of different technologies? Resolving issues such as these will affect the acquisition strategy for upgrading the En Route system. For example, the use of different technologies will influence the design character of the En Route system. This will consequently effect the ability to integrate different components and influence the amount of developed integration code that may be required. Clearly, the ability to optimize the acquisition strategy will have far reaching consequences for the FAA and must be carefully considered. This report addresses the use of different technologies and an architecture trade off approach to a typical En Route system problem. We were requested to consider the problem of resectorization, i.e., the combination and decombination of sectors (and fix posting areas) during operation of an En Route center. Such capabilities may become desirable for an implementation of free flight. Two technologies have been applied to develop solutions to this problem, namely Common Object Request Broker Architecture (CORBA) and POSIX.21 (Portable Operating System Interface Standard). The former is based on an object oriented model, while the latter is based on a message passing model.

DTIC

Air Navigation; Free Flight; Messages; Resolution; Architecture (Computers); Air Traffic Control

19980203401 Geoloc Corp., Arlington, VA USA

Global Ionospheric Specification from GPS and Airglow Data Final Report, 4 Apr. 1997 - 3 Apr 1998

Reilly, Michael H., Geoloc Corp., USA; Singh, Malkiat, Geoloc Corp., USA; May 07, 1998; 11p; In English

Contract(s)/Grant(s): N00014-97-C-0113

Report No.(s): AD-A343777; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The efficacy of GPS data-processing algorithms with the RIBG model is demonstrated, as is the problem with low latitude ionospheric models, by comparison of predictions from GPS-updated RIBG predictions with independent Topex, and incoherent scatter (ISR) data. Alternate plans are developed to solve the low-latitude model problem, and still retain a practical program for real-time processing of GPS data for ionospheric specification. In the regard, the GPS data-processing algorithms have been revamped for efficiency, now being an order of magnitude faster than before. This enables our program to meet high data throughput requirements for processing and updating GPS data from a global network of GPS receivers for global, near-real-time ionospheric specification. Algorithms have been partially developed to process multistation data for this purpose. The implications of our work for radio systems, ionospheric model development, and other developments are discussed, as well as its relationship to other work in this field.

DTIC

Global Positioning System; Atmospheric Models; Earth Ionosphere; Algorithms

19980203402 Naval Research Lab., Space Applications Branch, Washington, DC USA

Reliability Assessment Test (RAT) Program Life Data Analysis Methods

Danzy, Fredrick, Naval Research Lab., USA; Smathers, Jean S., Naval Research Lab., USA; May 08, 1998; 16p; In English

Report No.(s): AD-A343778; NRL/MR/8150--98-8161; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Two life data analysis methods, which will be employed in the Global Positioning System Block IIR Rubidium Atomic Frequency Standard Assessment Test Program will be discussed. The analysis methods will provide information regarding the population characteristics.

DTIC

Frequency Standards; Reliability; Evaluation; Data Processing; Atomic Clocks

AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

19980203229 Defence Science and Technology Organisation, Canberra, Australia

Strain Surveys of Fuel Flow Vent Hole Number 13 and Stiffener Runout Number 2 in the F111 Wing Pivot Fitting for a Range of Rework Shapes

Watters, Kevin C., Defence Science and Technology Organisation, Australia; Aug. 1997; 197p; In English

Report No.(s): AD-A343707; DSTO-TR-0567; DODA-AR-010-305; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

The strain distributions and magnitudes at two locations in the D6ac steel wing pivot fitting (WPF) of the F-111 aircraft have been evaluated by full-scale test of a wing. These locations, known as fuel flow vent hole number 13 and stiffener runout number 2 have been sites of in-service fatigue cracking. The structural features at these two locations produce large stress concentrations and extensive yielding occurs around them under cold proof load testing (CPLT) of the wing (which was simulated in these tests). These locations are subject to in-service reworking to remove detected fatigue cracks, and a range of reworks was simulated in these tests. The interaction of residual stress/strain states (after cyclic plasticity from CPLT loading) and material removal (during reworking) made interpretation of the strain versus load behaviour quite difficult. The difficulty was compounded by an overriding bi-linear elastic structural behaviour of the WPF and complex structural behaviour of the shear web in the WPF. A comprehensive strain versus load data base has been established for these locations to facilitate stress and fatigue analyses.

DTIC

Wings; F-111 Aircraft; Fuel Flow; Strain Distribution; Vents; Surveys; Pivots; Full Scale Tests; Fatigue Testing Machines; Cracking (Fracturing)

19980203350 Unistry Associates, Inc., Havertown, PA USA

Integrated Thermal Management of Advanced Aircraft Final Report, 9 Jun. 1997 - 9 Mar. 1998

Issacci, Farrokh, Unistry Associates, Inc., USA; Traci, Richard, Unistry Associates, Inc., USA; Mar. 1998; 41p; In English

Contract(s)/Grant(s): F33615-97-C-2735

Report No.(s): AD-A339236; UAI-98-002; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of the proposed effort was to evaluate the U.S. Air Force sponsored Vehicle Integrated Thermal Management Analysis Code (VITMAC) for: (1) including an optimization/expert systems architecture for analyzing thermal/fluid network configurations at the component, subsystems, and system level, and (2) coupling VITMAC with engine performance and cycle codes to provide a more integrated mission analysis capability as well as more accurate definitions of thermal loads. This effort resulted in the inclusion in VITMAC of a flow condition optimization method which automatically determines component operation to match user-specified thermal circuit operating conditions. This was the first step in implementing a plan for a multi-level optimization method which was developed for a Phase II program. Various engine performance and cycle models were evaluated which resulted in the recommendation that VITMAC be linked with APL's RJP ram/scramjet engine performance code as well as NASA's CEA rocket performance model and NNEP turbine engine cycle code. Finally, a plan for commercializing VITMAC was developed which includes: (1) enhancing the graphical user Interface (GUI) to make it more user friendly and robust, (2) organizing workshops to provide industrial experts with influence on and knowledge of VITMAC capabilities, (3) providing end-user support and training and, (4) developing a market plan for transferring the technology for aircraft and non-aircraft applications.

DTIC

Architecture (Computers); Circuits

19980203484 Wayne State Univ., Inst. for Manufacturing Research, Detroit, MI USA

Thermal Wave Imaging of Hidden Corrosion Final Report, 1 Jul. 1996 - 31 Dec. 1997

Thomas, Robert L., Wayne State Univ., USA; Favro, Lawrence D., Wayne State Univ., USA; Kuo, Pao-Kuang, Wayne State Univ., USA; Apr. 03, 1998; 17p; In English

Contract(s)/Grant(s): F49620-96-1-0166

Report No.(s): AD-A343638; AFRL-SR-BL-TR-98-0336; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A program of basic research was carried out, whose objective was to make the promising qualitative thermal wave imaging NDI technique a truly quantitative tool, which can have a major impact on the rapid, wide-area inspection of Air Force aircraft for hidden corrosion. Such thermal wave images of a square foot (or so) of aircraft skin are acquired on short time scales (a few seconds). Techniques were developed and studied to measure skin thickness and to identify corrosion products. The resulting corrosion analysis has been shown to have a quantitative capability of measuring material losses as small as 1% on aluminum aircraft

skins, and can be implemented rapidly to evaluate regions of corrosion which have been identified in the thermal wave images. The technique has also been shown to be capable of measuring intergranular corrosion in the vicinity of fasteners in KC-135 and B-52 wing skins.

DTIC

Aircraft Maintenance; B-52 Aircraft; Thermal Mapping; Imaging Techniques; Thickness; C-135 Aircraft; Intergranular Corrosion

19980203893 Cornell Univ., Dept. of Theoretical and Applied Mechanics, Ithaca, NY USA

Synergistic Diagnostics of Aircraft Materials and Structures Final Report, 15 May 1995 - 14 Aug. 1997

Sachse, Wolfgang, Cornell Univ., USA; Mar. 15, 1998; 16p; In English

Contract(s)/Grant(s): F49620-95-1-0383

Report No.(s): AD-A344202; AFRL-SR-BL-TR-98-0423; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This final report summarizes the results obtained with a synergistic measurement system used as the basis of a diagnostic system for monitoring and characterizing aircraft materials and structures. The system utilizes the development of an empirical model describing the characteristics and dynamics of the material or structure. It is demonstrated that this approach is useful for processing the signals of linear as well as non-linear systems. The linear modeler has been used to obtain a characterization of the strength and location of impacts on a truss-like structure. While the more general, automatic modeler which resembles a multi-dimensional, non-parametric regression approach was utilized to locate sources of acoustic emissions in a structure and also to predict fatigue crack growth in Al alloys under different loading conditions. Applications have been to measured as well as existing data which comprise a corrosion-fatigue material property data base. It was found that the prediction performance of the modeler is excellent if the measured input data closely resembles one of the previous data sets residing in the memory. An enhanced predictive performance can be obtained from the modeler if a predictor-corrector algorithm is used.

DTIC

Aircraft Structures; Aircraft Maintenance; Mathematical Models; Acoustic Emission; Diagnosis; Crack Propagation; Fatigue (Materials)

19980203908 Naval Postgraduate School, Monterey, CA USA

A Case Study: Acquisition Reform and the New V-22 Osprey Program

Riegert, Paul M., Naval Postgraduate School, USA; Mar. 1998; 139p; In English

Report No.(s): AD-A344702; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This thesis provides background information on the once cancelled V-22 program and acquisition reform and then examines the impact of the latter on the former. It analyzes the V-22 program using DoD's ten guiding principles of acquisition reform as a standard and concludes that acquisition reform is having mixed results on this Major Defense Acquisition Program. Much is being accomplished with acquisition reform in the V-22 program. A transformation of the business process from the top down is enabling the program office and its prime contractors to optimize cost, schedule, and performance. Earned value management metrics are actively being incorporated into the program's risk management process. Concurrent contractor Government testing and maintenance reduces test time required by 72 percent Cross functional IPTs, as the backbone of the program, are breaking down 'stove pipes' and facilitating concurrent engineering. Successfully implementing initiatives like CAIV and CLS and focusing on overall cost of ownership are reducing the cost of the program from cradle to grave. Commercial products and processes, like the Allison AE-1107C engine and CATIA software, are providing high quality systems at market controlled prices. Commercial item acquisition and CLS are being used effectively to minimize life cycle costs. 'Win-Win' contracting with industry is providing engine reliability that should improve with time and save 30 percent in support costs. Much can be accomplished still. Realistic contingency finding should be included in fiscal budgets to eliminate the migration of funds from R&D and PROC to O&S. SPI should be altered to pass a proportion of any program related savings back to the program office.

DTIC

Concurrent Engineering; V-22 Aircraft

19980205668 Newcastle-upon-Tyne Univ., Dept. of Computing Science, Newcastle, UK

Airbus Traceability Case Study

Pearson, S., Newcastle-upon-Tyne Univ., UK; Rowlands, M., Newcastle-upon-Tyne Univ., UK; Dec. 1997; 46p; In English

Report No.(s): PB98-147937; TRS-606; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

A preliminary traceability method was introduced previously which detailed the construction of the traceability structures following a method which consisted of four main parts: an underlying model, a language, defined steps and ordering, and guid-

ance; this was based on the conceptual framework proposed in the ATMOSPHERE project. The method was applied to the Attitude Monitor case study provided by Military Aircraft; the results of the case study formed part of the guidance for the method. NTIS

Attitude Indicators; Software Engineering

19980206272 Naval Postgraduate School, Monterey, CA USA

Solid Modeling for Rotary Wing Design at NPS with AutoCAD R13

Lincoln, Jeffrey S., Naval Postgraduate School, USA; Dec. 1997; 109p; In English

Report No.(s): AD-A345698; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This thesis is intended to be a reference for solid modeling and Computer Aided Design (CAD) tailored specifically for the Naval Postgraduate School's capstone helicopter design course, AA 4306. The goal is to present the use of AutoCAD R13 software as a central design tool throughout the conceptual design phase of the American Helicopter Society (AHS) Graduate Design Competition project. The specifics of AutoCAD that are essential to performing the design project are explored through examples of model construction and lessons learned from the 1997 VIPER design effort. The USAge of solid modeling as a design tool for design team integration is investigated. It is intended for this work to allow future classes to acquire sufficient proficiency with Computer Aided Design and solid modeling. Maximizing the practical USAge of CAD techniques in a single quarter will provide an improved learning experience in a more realistic design environment.

DTIC

Computer Aided Design; Helicopters; Helicopter Design; Rotary Wings

07

AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.

19980203267 Portsmouth Univ., Dept. of Mechanical and Manufacturing Engineering, Portsmouth, UK

The Effects of LCF Loadings on HCF Crack Growth Final Report

Hall, R. F., Portsmouth Univ., UK; Powell, B. E., Portsmouth Univ., UK; Apr. 28, 1998; 44p; In English

Contract(s)/Grant(s): F61708-97-W-0112

Report No.(s): AD-A344374; EOARD-SPC-97-4021; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report results from a contract tasking University of Portsmouth as follows: The contractor will investigate the effects of low-cycle fatigue (LCF) on high-cycle fatigue (HCF) crack growth for aerospace propulsion applications.

DTIC

Fatigue (Materials); Crack Propagation; Loads (Forces); Performance Tests; Engine Parts

19980203496 California Inst. of Tech., Pasadena, CA USA

Mechanisms of Unsteady Flow in Scramjet Combustors Final Report, 1 Sep. 1996 - 31 Dec. 1997

Marble, Frank E., California Inst. of Tech., USA; Cadou, Christopher P., California Inst. of Tech., USA; Mar. 31, 1998; 56p; In English

Contract(s)/Grant(s): F49620-96-1-0435; AF Proj. 2308

Report No.(s): AD-A343276; AFRL-SR-BL-TR-98-0364; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report covers analytic and experimental gasdynamic studies relevant to stability issues of the scramjet supersonic combustion chamber. Its intended purpose was to search for small amplitude very short time scale precursor signals which eventually grew into combustor flow instability, but at a much longer time scale than the signal itself, and consequently offer possibility of control before amplitudes got out of hand. The experiments were done in a basic 2.5 Mach number stream with an artificially thickened boundary layer corresponding to the ingested ramp boundary layer that occurs in the usual installation. A disturbance produced downstream by a small shock tube discharging normally to the gas flow successfully disgorged the shock structure; time resolved pressure and Schlieren image records were obtained. Because upstream signal propagation through the subsonic boundary layer of a supersonic flow is seen as an important issue in the phenomenon under investigation, a rudimentary analytic model was developed. It consists of an acoustically compact element, in which mixing and heat release may occur, with long constant area ducts upstream and downstream of this element. It employs a two stream one dimensional approximation, the main supersonic

stream and a subsonic second stream representing the thick boundary layer. Conditions under which interfacial disturbances may be propagated upstream are examined through several examples.

DTIC

Gas Dynamics; Unsteady Flow; Supersonic Combustion; Supersonic Combustion Ramjet Engines; Combustion Chambers

19980206364 NASA Lewis Research Center, Cleveland, OH USA

The High Stability Engine Control (HISTEC) Program: Flight Demonstration Phase

DeLaat, John C., NASA Lewis Research Center, USA; Southwick, Robert D., Pratt and Whitney Aircraft, USA; Gallops, George W., Pratt and Whitney Aircraft, USA; Orme, John S., NASA Dryden Flight Research Center, USA; Jul. 1998; 14p; In English; 34th; Joint Propulsion Conference, 12-15 Jul. 1998, Cleveland, OH, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Contract(s)/Grant(s): RTOP 523-53-13

Report No.(s): NASA/TM-1998-208482; E-11257; NAS 1.15:208482; AIAA Paper 98-3756; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Future aircraft turbine engines, both commercial and military, must be able to accommodate expected increased levels of steady-state and dynamic engine-face distortion. The current approach of incorporating sufficient design stall margin to tolerate these increased levels of distortion would significantly reduce performance. The objective of the High Stability Engine Control (HISTEC) program is to design, develop, and flight-demonstrate an advanced, integrated engine control system that uses measurement-based estimates of distortion to enhance engine stability. The resulting distortion tolerant control reduces the required design stall margin, with a corresponding increase in performance and decrease in fuel burn. The HISTEC concept has been developed and was successfully flight demonstrated on the F-15 ACTIVE aircraft during the summer of 1997. The flight demonstration was planned and carried out in two phases, the first to show distortion estimation, and the second to show distortion accommodation. Post-flight analysis shows that the HISTEC technologies are able to successfully estimate and accommodate distortion, transiently setting the stall margin requirement on-line and in real-time. This allows the design stall margin requirement to be reduced, which in turn can be traded for significantly increased performance and/or decreased weight. Flight demonstration of the HISTEC technologies has significantly reduced the risk of transitioning the technology to tactical and commercial engines.

Author

Engine Control; Gas Turbine Engines; Flight Tests; F-15 Aircraft; Flow Distortion; Real Time Operation; On-Line Systems; Control Systems Design; Inlet Pressure; Stability Augmentation

08

AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

19980203955 NASA Langley Research Center, Hampton, VA USA

Modeling the Benchmark Active Control Technology Wind-Tunnel Model for Active Control Design Applications

Waszak, Martin R., NASA Langley Research Center, USA; Jun. 1998; 30p; In English

Contract(s)/Grant(s): RTOP 522-33-11-01

Report No.(s): NASA/TP-1998-206270; NAS 1.60:206270; L-17625; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes the formulation of a model of the dynamic behavior of the Benchmark Active Controls Technology (BACT) wind tunnel model for active control design and analysis applications. The model is formed by combining the equations of motion for the BACT wind tunnel model with actuator models and a model of wind tunnel turbulence. The primary focus of this report is the development of the equations of motion from first principles by using Lagrange's equations and the principle of virtual work. A numerical form of the model is generated by making use of parameters obtained from both experiment and analysis. Comparisons between experimental and analytical data obtained from the numerical model show excellent agreement and suggest that simple coefficient-based aerodynamics are sufficient to accurately characterize the aeroelastic response of the BACT wind tunnel model. The equations of motion developed herein have been used to aid in the design and analysis of a number of flutter suppression controllers that have been successfully implemented.

Author

Active Control; Dynamic Characteristics; Wind Tunnel Models; Mathematical Models; Dynamic Response; Design Analysis

19980204841 Florida Atlantic Univ., Dept. of Mechanical Engineering, Boca Raton, FL USA

Parallel-Computing Concepts and Methods in Large Scale Floquet Analysis of Helicopter Trim and Stability Final Report

Gaonkar, G. H., Florida Atlantic Univ., USA; Subramanian, S., Florida Atlantic Univ., USA; Venkataratnam, S., Florida Atlantic Univ., USA; Mar. 03, 1998; 60p; In English

Contract(s)/Grant(s): DAAH04-94-G-0185

Report No.(s): AD-A344155; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Rotorcraft stability investigation involves a nonlinear trim analysis for the control inputs and periodic responses, and, as a follow-up, a linearized stability analysis for the Floquet Transition Matrix (FTM), and its eigenvalues and eigenvectors. The trim analysis is based on a shooting method with damped Newton iteration, which gives the FTM as a byproduct, and the eigenanalysis on the QR method; the corresponding trim and stability analyses are collectively referred to as the Floquet analysis. A rotor with Q blades that are identical and equally spaced has Q planes of symmetry. Exploiting this symmetry, the fast-Floquet analysis, in principle, reduces the run time and frequency indeterminacy of the conventional Floquet analysis by a factor of Q. It is implemented on serial computers and on all three types of mainstream parallel computing hardware: SIMD and MIMD computers, and a distributed computing system of networked workstations; large models with hundreds of states are treated. A comprehensive database is presented on computational reliability such as the eigenvalue condition number and on parallel performance such as the speedup and efficiency, which show, respectively, how fast a job can be completed with a set of processors and how well their idle times are minimized. Despite the Q-fold reduction, the serial run time is excessive and grows between quadratically and cubically with the number of states. By contrast, the parallel run time can be reduced dramatically and its growth can be controlled by a judicious combination of speedup and efficiency. Moreover, the parallel implementation on a distributed computing system is as routine as the serial implementation on a workstation.

DTIC

Aerodynamic Stability; Helicopters; Aircraft Models; Parallel Processing (Computers); Floquet Theorem; Helicopter Control; Stability Tests; Nonlinearity

09

RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

19980203397 Calspan Corp., Flight Research Dept., Buffalo, NY USA

Vista NF-16D Programmable Display System Development Final Report, Mar. 1997 - Mar 1998

Bailey, Randall E., Calspan Corp., USA; Landers, Thomas F., Calspan Corp., USA; Apr. 1998; 15p; In English

Contract(s)/Grant(s): F33615-93-C-3608; AF Proj. 3005

Report No.(s): AD-A343745; AFRL-VA-WP-TR-98-3019; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Wright Laboratory's Variable Stability In Flight Simulator Test Aircraft (VISTA) NV-16D is the newest in flight simulator in the USAF inventory. This unique research aircraft will perform a multitude of missions: to evaluate flight characteristics of new aircraft that have not yet flown, to perform research in the areas of flying qualities, flight control design, pilot vehicle interface, weapons and avionics integration, and to train test pilots and engineers. The VISTA is being upgraded to enhance its simulation fidelity and its research capabilities through the addition of a programmable Helmet Mounted Display (HMD) and head up display (HUD) in the front cockpit. The programmable helmet mounted display system consists of a GEC Marconi Avionics Viper 2 Helmet Mounted Optics Module integrated with a modified Helmet Integrated Systems Limited (HISL) HGU-86/P helmet, the Honeywell Advanced Metal Tolerant tracker, and a GEC Marconi Avionics Programmable Display Generator. The monocular HMD system is designed for growth to stereo on video, binocular capability. Lessons learned in the VISTA HMD development are reviewed. An outline of the proposed VISTA HMD demonstration flight is given to highlight the VISTA programmable displays system capabilities.

DTIC

Product Development; Display Devices; Evaluation; Flight Characteristics; Design Analysis; Test Pilots; Training Analysis

19980203609 National Aerospace Lab., Tokyo, Japan

Roll Motion Restraint System for NAL 0.6 m MSBS

Kohno, Takashi, National Aerospace Lab., Japan; Sawada, Hideo, National Aerospace Lab., Japan; Kunimasu, Tetsuya, National Aerospace Lab., Japan; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 141-150; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Suspension of a wind tunnel model and control of its motion in 5 degrees of freedom is realized in the National Aerospace Laboratory (NAL) 0.6 m Magnetic Suspension and Balance System (MSBS), but roll motion of the model is not controlled. Controlling the roll motion by adding additional magnets for roll control is realized in some small facilities including the NAL 0.1 m MSBS, but it is not suitable for large wind tunnels. A mechanical roll motion control system for the 0.6 m MSBS is described and simulation and experimental results are presented.

Author

Roll; Magnetic Suspension; Wind Tunnel Models; Wind Tunnel Tests; Constraints

19980203610 Old Dominion Univ., Dept. of Aerospace Engineering, Norfolk, VA USA

Wind Tunnel Magnetic Suspension and Balance Systems With Transversely Magnetized Model Cores

Britcher, Colin P., Old Dominion Univ., USA; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 151-161; In English; Also announced as 19980203598

Contract(s)/Grant(s): NCC1-248; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper discusses the possibility of using vertically magnetized model cores for wind tunnel Magnetic Suspension and Balance Systems (MSBS) in an effort to resolve the traditional "roll control" problem. A theoretical framework is laid out, based on previous work related to generic technology development efforts at NASA Langley Research Center. The impact of the new roll control scheme on traditional wind tunnel MSBS configurations is addressed, and the possibility of demonstrating the new scheme with an existing electromagnet assembly is explored. The specific system considered is the ex- Massachusetts Institute of Technology (MIT), ex-NASA, 6-inch MSBS currently in the process of recommissioning at Old Dominion University. This system has a sufficiently versatile electromagnet configuration such that straightforward "conversion" to vertically magnetized cores appears possible.

Author

Wind Tunnels; Magnetic Suspension; Magnetic Cores; Balancing

19980203844 Air Force Research Lab., Air Vehicles Directorate, Wright-Patterson AFB, OH USA

Network Evaluation for Training and Simulation Final Report, 1 Feb. 1996 - 30 Nov. 1997

Purdy, Stephen G., Air Force Research Lab., USA; Wuerfel, Roger, Air Force Research Lab., USA; Barnhart, David, Air Force Research Lab., USA; Ewart, Ron, Air Force Research Lab., USA; Nov. 1997; 204p; In English

Contract(s)/Grant(s): AF Proj. 2403

Report No.(s): AD-A344849; AFRL-VA-WP-TR-1998-3013; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Advancements in networking hardware and software have increased the numbers of training and research simulators being used in networked environments. Various technical issues and problems involved with networking simulations exist, one of the most notable being latency. The Training Systems Product Group (ASC/YWE) of the Aeronautical Systems Center commissioned a study into some of these networking issues. This study was conducted by the Control Integration and Assessment Branch (AFRL/VACD), of Air Force Research Laboratory. The purpose of this study was to analyze different simulation network configurations to determine an optimized architecture for training purposes. This program was aimed at Unit Training Device (UTD) applications with low numbers of entities and sites. The basic training architecture of two LANs with a few local nodes connected together by a WAN was assumed. The ideal network configuration would minimize LAN/WAN latencies while maintaining simulation data accuracy. Analysis on both the local and entire network configurations was performed relative to effects of network loading. Issues such as bandwidth, latency, accuracy, thresholds, and delay compensation were investigated. Distributed Interactive Simulating (DIS) and DIS Lite protocols were used. DIS Lite, developed under a SBIR contract with MaK Technologies is a low bandwidth protocol for networked high fidelity flight simulations.

DTIC

Training Simulators; Wide Area Networks; Bandwidth

19980203988 Centre d'Etudes et de Recherches, Dept. of Aerothermodynamics, Toulouse, France

Measurement Techniques Developed for Cryogenic Flow in T2 Transonic Wind Tunnel

Seraudie, A., Centre d'Etudes et de Recherches, France; Archambaud, J. P., Centre d'Etudes et de Recherches, France; Mignosi, A., Centre d'Etudes et de Recherches, France; May 1998; 12p; In English; Also announced as 19980203985; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

T2 is an induction driven wind tunnel in which Reynolds number variations are obtained by increasing the total pressure ($P_{\text{sub } t} = 1.4 \text{ to } 3 \text{ bar}$) and reducing the total temperature ($T_{\text{sub } t} = 300 \text{ to } 110 \text{ K}$). The flow is driven by an injection of dry air at ambient temperature and cooled by another injection of liquid nitrogen. Advanced development of conventional techniques and modern measurement techniques have been performed for low-temperature cryogenic flows. This paper presents the evolu-

tion of the specific tools sometimes developed, always tested and mainly used for different 2D or 3D flows at ambient and cryogenic conditions. Firstly, it gives the developments performed in the field of anemometer and pressure probes to measure the flow quality of the cryogenic wind tunnel. Secondly, it describes the use of an infrared technique for the qualification of the boundary layer transition on 2D and 3D models. Finally, this paper presents some L.D.A. typical 2D and 3D measurements at ambient condition and the adaptation of this velocity measurement device to work in cryogenic conditions.

Author

Mechanical Measurement; Cryogenic Wind Tunnels; Transonic Wind Tunnels; Infrared Imagery; Reynolds Number; Aerodynamic Coefficients; Aerodynamics

19980203989 Imperial Coll. of Science Technology and Medicine, Dept. of Aeronautics, London, UK

Development of PIV for Two and Three Component Velocity Measurements in a Large Low Speed Wind Tunnel

Bearman, P. W., Imperial Coll. of Science Technology and Medicine, UK; Harvey, J. K., Imperial Coll. of Science Technology and Medicine, UK; Stewart, J. N., Imperial Coll. of Science Technology and Medicine, UK; May 1998; 10p; In English; Also announced as 19980203985; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The use of particle image velocimetry, PIV, to make measurements in flows generated around models in a low speed wind tunnel is described. The tunnel test section employed is 3m wide by 1.5m high. The problems associated with using PIV in air at large scale, and how they can be overcome, are discussed. Stereoscopic PIV is used to measure all three components of velocity in planes across a flow. Errors due to parallax that are present in velocity components measured in the plane of a light sheet when there is an accompanying flow through the sheet, are corrected. The flows studied are generated by a 1/8th scale passenger car model and a 1/8th scale model of an aircraft with a wing sweep of 70 degrees. It is found that a reasonable estimate of a mean flow field can be obtained by averaging as few as ten instantaneous spatial distributions of velocity.

Author

Particle Image Velocimetry; Low Speed Wind Tunnels; Velocity Measurement; Flow Measurement

19980205662 National Inst. of Standards and Technology, Gaithersburg, MD USA

National Voluntary Laboratory Accreditation Program 1998 Directory

White, V. R., National Inst. of Standards and Technology, USA; Jan. 1998; 312p; In English

Report No.(s): PB98-149123; NIST/SP-810-ED-1998; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

Approximately 700 laboratories in 23 fields of accreditation are included in the 1998 edition. The directory lists the name, address, contact person, phone and fax numbers, e-mail and ERL addresses (if available), accreditation renewal date, and scope of accreditation for each laboratory. The directory contains a description of the NVLAP program, a summary of laboratory accreditations, user instructions, followed by five laboratory indexes which are cross-referenced by NVLAP Lab Code: Index A, Listing by laboratory Name, Index B, Listing by Field of Accreditation; Index C, Listing by State/Country; Index D, Listing by Testing Laboratories by NVLAP Lab Code; and Index E, Listing of Calibration Laboratories by NVLAP Lab Code. The scope of accreditation are provided for testing and calibration laboratories in Indexes D and E respectively.

NTIS

Directories; Laboratories

19980206043 Universitaet der Bundeswehr, Lab. fuer Stroemungsmaschinen, Hamburg, Germany

A Quantitative 2D Density Measuring System Using UV Rayleigh Scattering at an Atmospheric Wind Tunnel

Jakiel, C., Universitaet der Bundeswehr, Germany; Fiedler, K., Universitaet der Bundeswehr, Germany; Sieber, O., Universitaet der Bundeswehr, Germany; May 1998; 10p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

An optical density measuring system based on Rayleigh scattering was installed in an atmospheric wind tunnel. The system monitors the scattered light induced by a laser sheet irradiating the flow field behind a plane VKI-1 turbine cascade. The measuring procedure needing very short time is based on a relative measurement. This paper presents a brief summary of fundamentals, the experimental setup, and the measurement principles. As experimental result plane density distributions at different blade heights are given for subsonic and transonic flow. The experimental data is compared to results of a three-dimensional Navier-Stokes calculation.

Author

Density Measurement; Rayleigh Scattering; Gas Jets; Cascade Flow; Optical Measuring Instruments; Turbines; Wind Tunnels

10 ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; space communications, spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

19980203817 Instituto Nacional de Pesquisas Espaciais, Space Mechanics and Controls Div., Sao Jose dos Campos, Brazil

Control system and flexible satellite interaction during orbit transfer maneuver

daSilva, Adenilson Roberto, Instituto Nacional de Pesquisas Espaciais, Brazil; deSouza, Luiz Carlos Gadelha, Instituto Nacional de Pesquisas Espaciais, Brazil; AAS/GSFC 13th International Symposium on Space Flight Dynamics; May 1998; Volume 1, pp. 501-510; In English; Also announced as 19980203775

Contract(s)/Grant(s): CNPq-520182/93-6

Report No.(s): AAS-98-343; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

In this paper the interaction between the attitude control system and the flexible structure of an artificial satellite during orbit transfer maneuver has been investigated. The satellite was modeled by a rigid central body with one or more flexible appendages. The dynamics equations were obtained by Lagrangean approach. The flexible appendages were treated as clamped-free beam and its displacement was discretized by assumed-mode method. In order to transfer the satellite, a typical Hohmann transfer and a burn-coast-burn strategy were used and the attitude was controlled by an on-off controller. During transfer procedure a global analysis of satellite has been done, such as: performance of control system, influence of elastic response in control system, thruster firing frequency, fuel consumption and variation of orbital elements. In order to avoid the interaction with structure motion, a control system with bandwidth of one decade below the fundamental frequency was used. In the simulations the firing frequency was evaluated in an approximately way but kept below the fundamental frequency of the structure. The control system has kept the attitude below the specifications. As a result, the orbit transfer maneuvering has been done correctly without excessive excitation of flexible appendage.

Author

Attitude Control; Flexible Spacecraft; Fuel Consumption; Artificial Satellites; Flight Control; Automatic Control; Orbital Maneuvers

11 CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; propellants and fuels; and materials processing.

19980203905 Dayton Univ., Research Inst., OH USA

Advanced Fuel Development and Fuel Combustion Final Report, 1 Jun. 1992 - 1 Jun. 1997

Swartzbaugh, Joseph, Dayton Univ., USA; Aug. 1997; 46p; In English

Contract(s)/Grant(s): F33615-92-C-2218; AF Proj. 3048

Report No.(s): AD-A344488; WL-TR-97-2084; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This final report summarizes the efforts performed over the last five years on Contract F33615-92-C-2218. This report represents a collection of research programs, varying broadly in size and complexity with many authors and principal investigators. The objective of this task order contract was to support long-term basic and applied research for problems related to aviation turbine fuels and related materials and combustion of these fuels in advanced systems. Some research and development efforts aimed at evaluating advanced lubricants and lubrication systems were also performed in this contract.

DTIC

Research Management; Fuel Combustion; Aircraft Fuels

19980206010 Reading Univ., Dept. of Physics, UK

Application of FTIR Spectroscopy to Measurement of Gas Turbine Engine Exhaust Emissions

Hilton, M., Reading Univ., UK; Lettington, A. H., Reading Univ., UK; May 1998; 6p; In English; Also announced as 19980206002

Contract(s)/Grant(s): CEC-BRPR-CT96-0142; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Fourier Transform Infrared (FTIR) spectroscopy has been used to study the exhaust emissions from a static Rolls Royce Avon gas turbine engine. The thermal infrared emission from the hot exhaust gases was monitored non-intrusively from a distance of 5 meters using a high spectral resolution FTIR spectrometer fitted with a 16 cm aperture telescope. The gas temperatures were

determined by comparing the intensity of the measured saturated CO₂ emission band with the radiance of a black body radiation source at known temperatures. CO and CO₂ gas concentrations were determined by comparison with modelled spectra taking into account instrument effects. The results were compared with earlier extractive gas analysis and non-intrusive measurements made on the same engine prior to its recent refurbishment. Improvements in the equipment used for non-intrusive measurements and in the analytical procedures have improved the sensitivity and the confidence with which such quantitative measurements may be made.

Author

Exhaust Emission; Gas Turbine Engines; Nonintrusive Measurement; Gas Temperature; Fourier Transformation; Infrared Spectroscopy; Gas Composition; Exhaust Gases

19980203345 Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine, France

Thermal Barrier Coatings *les Revêtements anti-mur de chaleur*

Apr. 1998; 177p; In English; In French; 85th; AGARD Structures and Materials Panel, 15-16 Oct. 1997, Aalborg, Denmark; Sponsored by Advisory Group for Aerospace Research and Development, France

Report No.(s): AD-A344715; AGARD-R-823; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

No Abstract

Author

Thermal Control Coatings; Aircraft Engines; Ceramic Coatings; Thermal Conductivity; Inlet Temperature; Barriers; Turbines; Yttria-Stabilized Zirconia; Jet Engines

19980203910 Acurex Environmental Corp., Mountain View, CA USA

Control Technology for Depainting Operations: Estimation of Life-Cycle Costs of Controlling Methylene Chloride in Aircraft-Depainting Operations Versus Alternative Processes *Final Report*

Venkatesh, Shyam, Acurex Environmental Corp., USA; Wolbach, C. D., Acurex Environmental Corp., USA; Waterland, Larry R., Acurex Environmental Corp., USA; Nov. 24, 1997; 155p; In English

Contract(s)/Grant(s): F08637-95-D6003/DO5303

Report No.(s): AD-A344806; FR-97-104; AL/EQ-TR-1997-0046; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Stripping the paint and other coatings from aircraft frames using chemical stripper formulations based on methylene chloride (MC) has been a standard practice at Air Logistics Centers (ALCs) for more than 50 years. The US Environmental Protection Agency (EPA) has recently listed MC as a hazardous air pollutant and has subsequently issued National Emissions Standards for Hazardous Air Pollutants (NESHAPs) for major source categories. EPA specifically promulgated MC NESHAPs for Aerospace Manufacturing and Rework Facilities in September 1995. These standards will require paint stripping facilities that continue to use MC to implement MC emission controls that are at least 95% efficient by 1 September 1998. This report discusses the technical feasibility and costs of replacing current MC-stripping operations at ALCs with alternative stripping processes, discusses various MC-control technologies and control strategies that could be applied to current MC-stripping operations at ALCs, and estimates the life-cycle costs of selected alternative processes and MC-control strategies. These estimated life-cycle costs, and the procedures used to derive them, can be used by depainting facility managers to support informed decisions in their selection of NESHAP compliance approaches.

DTIC

Chlorides; Airframes; Methylene; Chemical Compounds; Paints; Life Cycle Costs; Air Pollution; Paint Removal

12 ENGINEERING

Includes engineering (general); communications and radar; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

19980206002 Advisory Group for Aerospace Research and Development, Propulsion and Energetics Panel, Neuilly-Sur-Seine, France

Advanced Non-Intrusive Instrumentation for Propulsion Engines *L'Instrumentation Non-Invasive Avancee pour les Propulseurs*

Advanced Non-Intrusive Instrumentation for Propulsion Engines; May 1998; 550p; In English; In French; 90th, 20-24 Oct. 1997, Brussels, Belgium; Also announced as 19980206003 through 19980206050; Original contains color illustrations

Report No.(s): AGARD-CP-598; ISBN 92-836-0055-X; Copyright Waived; Avail: CASI; A23, Hardcopy; A04, Microfiche

Changes in engine technology such as higher temperatures, higher tip speeds, new metal/composite/ceramic materials together with radical changes in design philosophy will require amongst other prerequisites the ability to measure and to monitor key internal gas and structural characteristics. The symposium papers presented non-intrusive measurement and analysis technologies in the following categories: Laser Point Measurements (11); Absorption and Infrared Techniques (4); Paints - Surface Sensors (6); Laser Induced Fluorescence (6); Mechanical (7); Films (5); Laser Planar Measurement (9); and a Keynote Address

Author

Nonintrusive Measurement; Propulsion; Engine Parts; Gas Turbine Engines; Optical Measurement; Laser Applications; Combustion

19980203841 Naval Postgraduate School, Monterey, CA USA

Radar Cross Section Reduction: Geometric control of Discontinuities Using Serrated Edges

Yong, Matthew K., Naval Postgraduate School, USA; Mar. 1998; 60p; In English

Report No.(s): AD-A343828; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The objective of this thesis is to investigate and evaluate the effectiveness of radar cross section (RCS) reduction by means of the geometric control of discontinuities using serrated edges. Although the use of serrated edges for RCS reduction can be clearly seen on stealth aircraft such as the Northrop B-2, and was mentioned in several papers and references, not much data on the reduction magnitude, the associated geometry, or the design methodology are available in the open literature. Parameters of interest include the number of basic serration cells (triangles) required per wavelength, and the aspect ratio of the triangles that form the zig zags. An infinitely thin metallic plate is considered for the analysis. The RCS of such a plate with serrated edges is computed and compared against the RCS of a plate of the same sized without serrated edges. The infinitely thin assumption is valid if the wing of the aircraft, which is represented by the plate, is thin compared to the wavelength. The results obtained show significant reduction in RCS.

DTIC

Radar Cross Sections; Aspect Ratio; Triangles; Thin Plates; Wings

19980205076 National Inst. of Standards and Technology, Electromagnetic Fields Div., Boulder, CO USA

Time-Domain Calibrations of D-Dot Sensors

Johnk, R. T., National Inst. of Standards and Technology, USA; Ondrejka, A. R., National Inst. of Standards and Technology, USA; Feb. 1998; 46p; In English

Report No.(s): PB98-149099; NIST/TN-1392; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This technical note covers in detail the procedures that are necessary to measure the receiving transfer function of broadband electric-field sensors using direct-pulse, time-domain methods. The calibration techniques presented here are applied to a cone and ground plane system in the 50 MHz to 14 GHz frequency range, as well as to a TEM cell in the 10 MHz to 100 MHz range. Measurement results using both types of facilities are presented for selected D-Dot sensors. In addition to a comparison of results from the two measurement facilities in the overlapping frequency range, a thorough combined uncertainty analysis is presented.

NTIS

Aircraft Equipment; Electromagnetic Radiation; Antennas; Calibrating; Transfer Functions; Broadband; Sensors

19980203631 National Aerospace Lab., Tokyo, Japan

Superconductive Solenoid for the NAL 60-cm MSBS

Sawada, Hideo, National Aerospace Lab., Japan; Kohno, Takashi, National Aerospace Lab., Japan; Kunimasu, Tetsuya, National Aerospace Lab., Japan; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 425-439; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The model position sensing system at the NAL 60-cm Magnetic Suspension and Balance System (MSBS) has been improved to provide a more accurate measurement of lateral positions by using an additional sensing camera mounted at the upper side of the test section. The MSBS is equipped with a model holding system in order to establish safe model release and capture. The holding system has a balance to monitor the load on the model while the system holds it. Suitable dimensions of the cylindrical model core for the MSBS are estimated. A larger MSBS for the 1.25 m high Reynolds number supersonic wind tunnel is designed by scaling up the dimensions of the 60-cm MSBS. A superconductive solenoid core is inevitable if suspending a model magnetically in the high Reynolds number supersonic wind tunnel. The proposed goal of the cylindrical core is 0.9 m long and 74 mm

in diameter, with 80 kA/sq cm current density. In order to examine its feasibility, a superconductive solenoid model core of 300 mm long and 45 kA/sq cm current density has been designed and built.

Author

Magnetic Suspension; Position Sensing; Solenoids; Supersonic Wind Tunnels; Superconducting Devices; Magnetic Cores

19980203581 Office National d'Etudes et de Recherches Aerospatiales, Paris, France

Modelling of the Mixing Noise of a Free Hot Supersonic Jet: Application of the Lilley's Equation *Modelisation du bruit de melange turbulent d'un jet libre supersonique chaud: Application de l'equation de Lilley*

Raguenet, Wilfrid, Office National d'Etudes et de Recherches Aerospatiales, France; 1998; ISSN 0078-3780; 176p; In French; Original contains color illustrations

Report No.(s): NT-1998-4; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche; US Sales Only; US Sales Only

The object of this thesis is to contribute to the modelling of mixing noise due to a hot supersonic jet. The acoustic field is computed using data from numerical simulations of the aerodynamic field, and applying an acoustic analogy. A CFD code using a k-epsilon turbulence closure has been applied for the computation of the aerodynamic field. The supersonic jet noise model is based on a shear flow analogy, governed by the Lilley's equation. The code is tested for high temperature and high speed circular free jets in the anechoic wind tunnel CEPRA 1 9 (CEPR, Soclay/ONERA) and in the MARTEL facility (CEAT, Poitiers). Finally, the computations show the importance of the radiation of Mach waves on the radiated acoustic field.

Author

Models; Sound Fields; Supersonic Jet Flow; Computation; Jet Aircraft Noise

19980203991 Glasgow Univ., Dept. of Aerospace Engineering, UK

Analysis of Complex Flow Fields by Animation of PIV and High Resolution Unsteady Pressure Data

Coton, F., Glasgow Univ., UK; Galbraith, R., Glasgow Univ., UK; Grant, I., Heriot-Watt Univ., UK; Hurst, D., Glasgow Univ., UK; May 1998; 10p; In English; Also announced as 19980203985; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

This paper describes the use of animation in the analysis of data from unsteady aerodynamic tests where the phenomena of interest vary both temporally and spatially. Particular emphasis is given to results from an investigation of blade vortex interaction (BVI) where both flow field and surface pressure data were recorded. It is shown that animation can be used, in a manner akin to basic flow visualisation, to identify the interesting features of such a flow and to, thus, guide more detailed conventional analysis techniques. The method adopted in this study involved the acquisition of a series of PIV images which were then processed and subsequently interpolated onto a regular grid. The temporal variation in velocity at each grid point was then established by a further interpolation between PIV frames. Finally, particles were placed in the initial velocity field and their subsequent trajectory during the interaction process calculated using a multi-step integration method.

Author

Particle Image Velocimetry; Flow Distribution; Velocity Distribution; Unsteady Aerodynamics; Pressure Measurement; Velocity Measurement; Flow Visualization; Aerodynamics

19980203993 Wright Lab., FIMO, Wright-Patterson AFB, OH USA

Recent Developments in Doppler Global Velocimetry

Beutner, Thomas J., Wright Lab., USA; Baust, Henry D., Wright Lab., USA; May 1998; 10p; In English; Also announced as 19980203985; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Doppler Global Velocimetry is a non-intrusive wind tunnel diagnostic technique which has the potential to make simultaneous three-component velocity measurements over entire planes in the flow field. Measurements of velocity are based on determining the Doppler shift of single frequency laser light scattered off particles in the flow field. This technique has been used in the Subsonic Aerodynamic Research Laboratory wind tunnel at Wright Laboratory to make qualitative measurements of the flow associated with a vortex-tail interaction. This flow field is typical of the flows seen on twin-tail fighter aircraft. This paper presents results obtained with the DGV instrument and reports the current progress and recommendations towards developing an improved diagnostic system.

Author

Aerodynamics; Velocity Measurement; Nonintrusive Measurement; Doppler Effect

19980204008 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. fuer Stroemungsmechanik, Goettingen, Germany

Skin Friction Measurement and Transition Detection Techniques for the Ludwig-Tubes at DLR

Schuelein, E., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Koch, S., Deutsche Forschungsanstalt fuer Luft-

und Raumfahrt, Germany; Rosemann, H., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; May 1998; 10p; In English; Also announced as 19980203985; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Three different skin friction measurement and transition detection techniques have been developed and adapted to the specific test conditions in the Ludwig-Tube facilities of DLR at Goettingen. The latter are: short run time and thin boundary layers for both, the hypersonic Ludwig-Tube facility (RWG) and the Cryogenic Ludwig-Tube (KRG), and low temperatures for the KRG, which can be operated down to 120 K to achieve high Reynolds numbers. An oil film technique has been developed and applied to measure skin friction and transition on a flat plate in the RWG at $M = 5$. The results are in good agreement with the Van Driest II and the Young correlation, respectively, and results from velocity profile measurements for the skin friction and hot-wire measurements for the transition location. Surface mounted hot-films, directly deposited on the model surface, have been used to study shock oscillations on a laminar type airfoil in the KRG down to cryogenic conditions. Further improvements of the deposition quality will make sensor arrays with about 20 sensors on an airfoil section with 150 mm chord available. It could be demonstrated that wall mounted thermocouples provide a simple method to determine transition on airfoils in the KRG by detecting the difference in heat flux between laminar and turbulent boundary layers. The results agree well with the interpretation of pressure distribution and wake measurements as well as with the transition location given by the MSES (Drela) code.

Author

Skin Friction; Airfoils; Airfoil Profiles; Friction Measurement; High Reynolds Number; Laminar Boundary Layer; Hypersonics

19980204009 Technische Univ., Inst. fuer Luft- und Raumfahrt, Berlin, Germany

Surface Forces Measurements with High Spatial and Temporal Resolution by Means of Liquid Crystal Foils, Piezofolios and Surface Hot-Film Arrays

Nitsche, W., Technische Univ., Germany; Suttan, J., Technische Univ., Germany; Haselbach, F., Technische Univ., Germany; Sturzebecher, D., Technische Univ., Germany; May 1998; 10p; In English; Also announced as 19980203985; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Steady and unsteady surface measurement techniques for subsonic and transonic flows are surveyed emphasizing the capabilities, restrictions and applications of these techniques in experimental aerodynamics. The present paper investigates comparatively the status and capabilities of a number of surface measurement techniques (Liquid Crystals, HotFilm-Arrays, Piezofilm-Arrays,) which are necessary for the understanding of distributed flow phenomena. Based on exemplary results, some of the main features of the measurement techniques are discussed. Emphasis is on recent improvements to obtain higher temporal and spatial resolution. This concerns e.g. the employment of pyroelectrical capabilities for higher signal-to-noise ratios in piezofilm array measurements, or the development of a standard calibration method for multisensor hot-film arrays with small stream-wise sensor spacing.

Author

Aerodynamics; Transonic Flow; Subsonic Flow; Signal to Noise Ratios; Liquid Crystals; Crystal Surfaces

19980204012 Pisa Univ., Dept. of Aerospace Engineering, Italy

Shear Sensitive Liquid Crystals in Subsonic and Transonic Wind Tunnel Testing

Lombardi, G., Pisa Univ., Italy; Morelli, M., Council for Scientific and Industrial Research, South Africa; May 1998; 10p; In English; Also announced as 19980203985; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The present paper singles out the advantages connected with the use of the liquid crystal technique for the visualization of the surface flow phenomena during wind tunnel test; they appear significant, and can be summarized in reversibility, non-toxicity and low cost. The more significant benefits are that different types of analysis (boundary layer transition, separation and reattachment, shock wave position) can be performed with a single technique, and that the reversibility of the process gives the possibility to analyze several conditions in a single run of the wind tunnel. Therefore, the technique is characterized by low cost and time requirements. In any case, it is important to note that several effects can affect the images and this implies a degree of uncertainty in the interpretation of the results. It is therefore necessary to acquire a high confidence level in the technique in order to assure a good degree of repeatability and accuracy in the analysis of the results. Mainly, the use of the technique is related to the visualization of the main feature of the surface flow. In this regard, several examples showing the determination of the boundary layer transition, separation lines and the shock wave position on the surface, are presented. to enhance the knowledge on the boundary layer conditions a quantitative use of this technique will be a powerful tool . Several attempts to Have a quantification of the response of the liquid crystals were carried out and are discussed in the paper. Nevertheless, it is necessary to stress that, at the present state

of the research, the technique is probably not precise enough for an absolute determination of the local shear stress, and the indicated procedure seems applicable only for comparative tests.

Author

Liquid Crystals; Transonic Flow; Subsonic Flow; Wind Tunnels; Shock Waves; Shear Stress; Boundary Layer Transition; Flow Visualization

19980206005 Centre National de la Recherche Scientifique, Lab. de Mécanique des Fluides et d'Acoustique, Ecully, France

Laser Two-Focus Flow Field Investigation within a High-Speed High-Pressure Centrifugal Compressor

Trebinjac, I., Centre National de la Recherche Scientifique, France; Claudin, I., Centre National de la Recherche Scientifique, France; .Advanced Non-Intrusive Instrumentation for Propulsion Engines; May 1998; 8p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The results of measurements carried out in a transonic centrifugal compressor with splitter vanes are presented and discussed. The laser two-focus anemometry technique is described, including the seeding control which is a crucial issue in a high temperature level environment. Whereas a potential flow structure exists up to the high meridional curvature region, the through flow pattern is largely distorted in the radial part of the impeller. Noticeable differences in flow pattern between both channels are found, particularly through the low momentum fluid zone locations. A qualitative study of the vortical mechanisms ascribes them to the tin clearance effects.

Author

Centrifugal Compressors; Flow Distribution; Laser Anemometers; Transonic Compressors; Flow Measurement; Potential Flow; Velocity Measurement; Nonintrusive Measurement

19980206008 Centre National de la Recherche Scientifique, Lab. de Mécanique des Fluides et d'Acoustique, Ecully, France

Laser Two Focus Anemometry (L2F-3D) for Three-Dimensional Flow Analysis in an Axial Compressor

Vouillarmet, A., Centre National de la Recherche Scientifique, France; Charpenel, S., Centre National de la Recherche Scientifique, France; May 1998; 12p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

In order to improve the accuracy of numerical simulations applied to the new generation of high loaded, high-speed turbomachines, a thorough understanding of the 3D phenomena is needed. For that purpose, the use of 3D experimental techniques, like 3D-L2F anemometry, is now absolutely necessary. This paper deals with a statistical method for processing the data. The point is that, during the acquisition procedure, marginal and conditional probability density functions (p.d.f.) are obtained, but they are already integrated quantities. Hence, it becomes impossible to derive analytical relations between the p.d.f. and the 3D first and second order momenta. However, an issue can be found using an isotropic turbulence hypothesis. This method has been, first of all, tested in an axisymmetrical free jet. Furthermore, an experimental investigation of the three dimensional flow field within the tip area of a high loaded, low-speed axial compressor was performed.

Author

Three Dimensional Flow; Turbocompressors; Velocity Measurement; Laser Anemometers; Data Processing; Flow Velocity; Free Jets; Statistical Analysis

19980206013 Universitaet der Bundeswehr Muenchen, Inst. fuer Strahlantriebe, Neubiberg, Germany

Laser-2-Focus Measurements on a Turbine Cascade with Leading Edge Film Cooling

Ardey, S., Universitaet der Bundeswehr Muenchen, Germany; Fottner, L., Universitaet der Bundeswehr Muenchen, Germany; Beversdorff, M., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Weyer, H., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; May 1998; 12p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

In order to increase the understanding of the aerodynamic processes dominating the flow field of turbine bladings with leading edge film cooling, isothermal investigations were carried out on a large scale high pressure turbine cascade. Close to the stagnation point the turbine cascade has one row of film cooling holes on the suction side and another one on the pressure side. Blowing ratio, turbulence intensity, Mach number, and Reynolds number are set to values typically found in modern gas turbines. Since a very sensitive flow pattern with high velocity gradients and reverse flow areas was to be expected near the blowing holes the Laser-2-Focus technique was selected for investigations in this area. Two independent systems were used: A standard two dimensional Laser-2-Focus system permanently installed in the wind tunnel and a temporarily set up three dimensional Laser-2-Focus system of the DLR-Institut fuer Antriebstechnik, Koln. The results of the two systems are in good agreement. They indicate vortices in the

exit plane of the film cooling holes developing into a flow pattern with upwinds directly behind the holes and downwinds further downstream. In the wake of the pressure side holes a large recirculation zone can be observed located below the coolant jet.

Author

Turbine Blades; Cascade Flow; Film Cooling; Optical Measuring Instruments; Aerodynamic Characteristics; Coolants; Leading Edges; Wind Tunnel Tests; Holes (Mechanics); Flow Measurement; Jet Flow

19980206017 Rolls-Royce Ltd., Applied Science Lab., Derby, UK

Recent Developments in the Application of Laser Doppler Anemometry to Compressor Rigs

Edmonds, Jonathan D., Rolls-Royce Ltd., UK; Harvey, David, Rolls-Royce Ltd., UK; Wiseall, Stephen S., Rolls-Royce Ltd., UK; May 1998; 10p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

A 3D Laser Doppler Anemometry (LDA) system capable of measuring comprehensive in rotor flowfields on high-speed compressor rigs has been developed by the Rolls-Royce Applied Science Laboratory. This paper describes the system and presents data from a recent compressor rig test.

Author

Laser Anemometers; Compressors; Test Stands; Velocity Measurement; Flow Velocity; Data Acquisition; Nonintrusive Measurement

19980206020 Purdue Univ., School of Aeronautics and Astronautics, West Lafayette, IN USA

Rotor Blade Pressure Measurement in a Rotating Machinery Using Pressure and Temperature Sensitive Paints

Torgerson, S., Purdue Univ., USA; Liu, T., Purdue Univ., USA; Sullivan, J., Purdue Univ., USA; May 1998; 12p; In English; Also announced as 19980206002; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Pressure and temperature sensitive paints have been utilized for the measurement of blade surface pressure and temperature distributions in a high speed axial compressor and an Allied Signal F109 gas turbine engine. Alternate blades were painted with temperature sensitive paints and then pressure sensitive paint. This combination allows temperature distributions to be accounted for when determining the blade suction surface pressure distribution. Measurements were taken and pressure maps on the suction surface of a blade were obtained over a range of rotational speeds. Pressure maps of the suction surface show strong shock waves at the higher speeds.

Author

Gas Turbine Engines; Turbocompressors; Pressure Measurement; Paints; Pressure; Surface Temperature; Compressor Blades; Suction; Temperature Measurement

19980206050 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. for Propulsion Technologie, Cologne, Germany

Applications of Three Dimensional Doppler Global Velocimetry to Turbo Machinery and Wind Tunnel Flows

Roehle, I., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Schodl, R., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; May 1998; 14p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Doppler Global Velocimetry is an imaging anemometer. A DGV system optimised for time averaged three component velocity measurements was designed and set up. The first application of the system was the investigation of the flow field of a swirl spray nozzle in a cylindrical CASIng. The flow field in the whole volume of the combustor was measured. The DGV System was also applied to investigate the wake region of a car model in a wind tunnel. An arrangement with three light sheets was chosen. The 3D-DGV results are in a good agreement with 3D-LDA measurements of the same flow. 3D-DGV measurements were carried out inside the model of the inlet of a fighter aircraft. A flexible endoscope was used to overcome the serious problems of the optical excess of this fully capsuled flow.

Author

Laser Doppler Velocimeters; Flow Characteristics; Flow Velocity; Velocity Measurement; Wind Tunnels; Turbomachinery; Equipment Specifications; Imaging Techniques

19980206208 General Electric Co., Aircraft Engines, Cincinnati, OH USA

The Technical and Economic Relevance of Understanding Boundary Layer Transition in Gas Turbine Engines

Wisler, David C., General Electric Co., USA; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 53-64; In English; Also announced as 19980206205; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This presentation addresses the technical and economic relevance of understanding boundary layer transition in gas turbine engines from two perspectives. The first is the micro perspective of the technologist and designer whose principal task is to untie

(or even cut) the Gordian knot of transition and thus, hopefully, produce better component designs. The second is the macro perspective of overall engine economics and reliability where the benefits of "this better component design obtained from improved understanding of transition" are compared to the benefits that could potentially be realized from improvements in other areas. From the micro perspective, we have now reached the point where our lack of ability to predict the location of boundary layer transition for components in gas turbine engines is impeding our ability to gain maximum benefit from our design effort. This is especially true for compressor and turbine blade rows with their respective relative motion between rotors and stators. Clearly the numerics for 2-D and 3-D Reynolds-averaged N-S solutions are in hand. So too is CPU computing power. What's missing is an adequate turbulence model, one that provides a practical, CFD design tool that will consistently and accurately predict transition and other boundary layer features for arbitrary flows. This missing link impedes designers in their efforts to tailor airfoil shapes to achieve increased loading and/or increased efficiency. With increased airfoil loading, engine part count can be reduced. With increased efficiency, engine fuel consumption is reduced. The presentation discusses the magnitudes of the benefits one might potentially achieve in these micro endeavors. From a macro perspective there are issues that are far more significant to engine economics than those involving the resolution of boundary layer transition. Understanding the relative importance of these issues enables one to get a better understanding of why the gas turbine industry is moving in its current direction. We are approaching a mature technology. Thus, we are becoming more of a cost-driven business and less of a technology-driven business, although our product is still "very high tech". With more maturity comes a focus on manufacturing costs, quality, product reliability and total cost of engine ownership. Design for Manufacture, Design for Reliability, Error Proofing Design, and Low Maintenance are heavy hitters economically. This presentation discusses the relative magnitudes of the benefits one might potentially achieve in these macro endeavors. Understanding transition phenomena is certainly important, but its importance also needs to be viewed in the context of total engine economics. With this understanding, the roles of industry, universities and government laboratories in finding solutions to the transition issue are discussed.

Author

Boundary Layer Transition; Gas Turbine Engines; Economics; Cost Effectiveness; Design Analysis; Technology Assessment

19980206209 Pratt and Whitney Aircraft, East Hartford, CT USA

Impact of Reynolds Number on LP Turbine Performance

Sharma, Om, Pratt and Whitney Aircraft, USA; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 65-69; In English; Also announced as 19980206205; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Experimental and numerical methods developed over the past twenty five years have permitted the designs of low pressure turbines, utilized in aircraft gas turbine engines, which yield very high efficiencies at sea level take off conditions. These turbines, however, encounter large loss in performance at the altitude cruise operating condition. This loss in performance can be attributed to the impact of Reynolds Number on the behavior of boundary layers on airfoil suction surfaces. Experimental and analytical results are shown in this paper to elucidate the problem encountered by the turbine design engineers. Experimental data consists of those acquired in an engine and a model rig environment. Analysis of these experimental data demonstrate shortcomings of models, criteria and correlations used in the current design procedures and point towards lack of current understanding of the actual operating environment in the gas turbine engine. Analytical results demonstrate limitations of turbulence/transition models used in a low Reynolds Number environment of low pressure turbines. Areas of further research are identified to provide support to the design community.

Author

Gas Turbine Engines; Aircraft Engines; Low Reynolds Number; Boundary Layer Transition; Turbulence Effects; Reattached Flow; Boundary Layer Separation; Turbulent Boundary Layer

19980206225 Cambridge Univ., Cambridge, UK

Transition in Leading-Edge Separation Bubbles

Khan, Rajesh, Cambridge Univ., UK; Cumptsy, Nick, Cambridge Univ., UK; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 315-321; In English; Also announced as 19980206205; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Separation bubbles are very common near the leading edge of airfoils. Although extending over a few percent of chord (normally less than 5 percent) they are of technological importance because they can determine the development of the boundary layer over the remainder of the chord. Measurements have shown that freestream turbulence has a very large effect on the nature of the bubble, with raised levels of turbulence leading to a pronounced shortening of the bubble. Quite different transition processes appear to be involved, depending on the level of turbulence and the incidence onto the airfoil. At low incidence no evidence of

spot transition could be seen, but at higher incidence and low freestream turbulence spots are clearly visible in the bubble shear layer.

Author

Bubbles; Boundary Layers; Boundary Layer Transition; Leading Edges; Low Turbulence; Free Flow; Airfoils; Transition Flow; Boundary Layer Separation

19980206229 Pennsylvania State Univ., University Park, PA USA

Prediction of Unsteady Transitional Layers in Turbomachinery Using Navier Stokes Equations

Lakshminarayana, B., Pennsylvania State Univ., USA; Chernobrovkin, A., Pennsylvania State Univ., USA; Kang, D. J., Pennsylvania State Univ., USA; Minnowbrook II 1997 Workshop on Boundary Layer Transition in Turbomachines; Jun. 1998, pp. 369-384; In English; Also announced as 19980206205

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The objective of the research reported in this presentation is to develop computational techniques for the prediction of unsteady transitional flows associated with the rotor stator interaction in turbomachinery. Three low-Reynolds number turbulence models are incorporated in two unsteady Navier-Stokes codes (one is pressure based and the other is time marching with Runge-Kutta time stepping) and evaluated for accuracy in predicting the onset and the end of unsteady transitional patches due to wake passing. The best model is then used for modification and improvement for the leading edge effect. An existing steady Navier-Stokes code was modified to include pseudo-time stepping, which provided acceleration from 5 to 25 times that of the original code. A systematic validation procedure was implemented to assess the effects of the grid, artificial dissipation, physical, and the pseudo-time step for an accurate prediction of transitional flows resulting from the rotor-stator interaction. The ability of the Navier-Stokes code to predict the unsteady transitional flow on a turbomachinery blade is demonstrated. The unsteady pressure and velocity fields are in good agreement with the experimental data and the prediction from the Euler/boundary layer approach. The numerical solver was able to capture all zones (wake induced transitional strip, wake induced turbulent strip, calmed region, etc.) associated with wake induced transition in a compressor cascade. Another significant step is the assessment of k-epsilon turbulence models, including the leading edge modifications. Best results were obtained from the FLB model. The LB model predicted earlier inception of the transition and shorter transition length. Modification of the k-epsilon model was found to be essential for an accurate prediction of the unsteady transitional flow in a compressor cascade. The CH model failed to predict the unsteady transitional flow. Predicted boundary layer was turbulent from the leading edge, even with the modification of the k-epsilon model near the stagnation point. A comparison of the instantaneous shape factor, the skin friction coefficient, and the momentum thickness indicates that the Navier-Stokes predictions are reasonably good. Interaction between the upstream wake and stator wake results in shedding of unsteady vortices from the trailing edge and increased dissipation in the stator wake and, as a consequence, increased rate of decay of the stator wake. The procedure developed at Penn State should aid the designers of turbomachinery in allowing for the unsteady transitional flows due to rotor-stator interaction.

Author

Computational Fluid Dynamics; Navier-Stokes Equation; K-Epsilon Turbulence Model; Runge-Kutta Method; Unsteady Flow; Transition Flow; Boundary Layer Transition; Stators; Turbomachinery; Computerized Simulation; Rotors; Rotor Stator Interactions

19980203987 NASA Langley Research Center, Hampton, VA USA

Advanced Measurement Technology at NASA Langley Research Center

Antcliff, Richard R., NASA Langley Research Center, USA; May 1998; 12p; In English; Also announced as 19980203985; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Instrumentation systems have always been essential components of world class wind tunnels and laboratories. Langley continues to be on the forefront of the development of advanced systems for aerospace applications. This paper will describe recent advances in selected measurement systems which have had significant impact on aerospace testing. To fully understand the aerodynamics and aerothermodynamics influencing aerospace vehicles, highly accurate and repeatable measurements need to be made of critical phenomena. However, to maintain leadership in a highly competitive world market, productivity enhancement and the development of new capabilities must also be addressed aggressively. The accomplishment of these sometimes conflicting requirements has been the challenge of advanced measurement developers. However, several new technologies have recently matured to the point where they have enabled the achievement of these goals. One of the critical areas where advanced measurement systems are required is flow field velocity measurements. These measurements are required to correctly characterize the flowfield under study, to quantify the aerodynamic performance of test articles and to assess the effect of aerodynamic vehicles on their environment. Advanced measurement systems are also making great strides in obtaining planar measurements of other important thermodynamic quantities, including species concentration, temperature, pressure and the speed of sound. Langley has

been on the forefront of applying these technologies to practical wind tunnel environments. New capabilities in Projection Moire Interferometry and Acoustics Array Measurement systems have extended our capabilities into the model deformation, vibration and noise measurement arenas. An overview of the status of these techniques and recent applications in practical environments will be presented in this paper.

Author

Aerospace Engineering; Aerodynamics; Aerospace Vehicles; Aerothermodynamics; Wind Tunnels; Thermodynamics; Flow Distribution; Mechanical Measurement

19980204004 MetroLaser, Irvine, CA USA

Advances in Aerodynamic Holography

Trolinger, James D., MetroLaser, USA; Millerd, James, MetroLaser, USA; Weber, David, MetroLaser, USA; Brown, Michael, MetroLaser, USA; May 1998; 18p; In English; Also announced as 19980203985

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Researchers continue to find new ways to employ holography to measure aerodynamic parameters in almost all flow regimes. Since holography provides a method to store optical wavefronts in such a fashion as to allow their reconstruction and analysis at a later time, it is a natural intermediate step for many conventional optical diagnostic procedures that employ interferometry, schlieren, deflectometry, particle image velocimetry, and three-dimensional visualization. For example, optical wavefronts representing one condition of a flow can be interfered directly with those representing a second condition, simply by storing the wavefronts holographically, providing at the same time a simple mechanism to subtract out all non varying conditions (such as optical defects). The result is a powerful method for the study of turbulent flow. These procedures have now been in use for many years and are reaching maturity, but the field is by no means stagnant. More recently, holographic techniques have been extended to include multiple wavelength recording holography at a wavelength tuned to include a resonance of a constituent in the flow, real-time holography (four wave mixing), and recording in photorefractive materials, SLM's, and CCD's. Also, new ways of using holograms to record, reconstruct and produce unique wavefronts for measurement have evolved. For example, holograms can be placed directly on a model surface to aid in measurement (optically smart surfaces). In resonance interferometry, sensitivity is enhanced by tuning the light to the resonance line of a substance, exploiting the large refractive index change caused by anomalous dispersion at resonance. Holography enhances this unique form of interferometry by allowing useful interference between two beams (of different wavelength) that pass through exactly the same paths at the same time. This further allows interferograms to be recorded in photorefractive materials in such a way that a cineholographic interferometry movie of the selected substance in the field of interest can be recorded. Four wave mixing (sometimes called real-time holography) provides a unique way to measure temperature in high pressure flows, where other optical methods usually fail. This paper will describe the principles behind holographic flow diagnostics with emphasis on the more recently developed methods, and will consider the future potential of holographic diagnostics in aerodynamics.

Author

Aerodynamics; Holographic Interferometry; Particle Image Velocimetry; Four-Wave Mixing

19980204017 Technische Univ., Darmstadt, Germany

The Status of Internal Strain Gage Balance Development for Conventional and for Cryogenic Wind Tunnels

Ewald, B., Technische Univ., Germany; May 1998; 10p; In English; Also announced as 19980203985; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The measurement of the aerodynamic forces is still the most important task in the wind tunnel at least for aircraft development work. Accuracy and reliability of the balance are key factors in this test technology. The urgent requirement for more and more accurate force testing leads to a demand for more and more balance accuracy. The most urgent demand in this field comes from the Cryogenic Tunnels like the NTF and the new European Wind Tunnel. The outcome of effort at the Darmstadt University of Technology is not only a cryogenic balance technology, which allows transport performance measurements in the ETW with a repeatability of less than one drag count with variable tunnel temperature but also a considerable improvement of balances for conventional tunnels. For this result all aspects of the balance technology had to be treated. For the balance design a computerized method was developed, which allows an optimization of the structural design in a short time. Principal aspects of the design were studied with Finite Element analysis for optimized solutions. The technique of the electron beam welded balance was established successfully. This construction method gives considerable advantages with respect to design for optimum structure stiffness and low interference. The difficult problem of strain gaging and wiring for cryogenic environment with severe moisture conditions was solved as a result of lengthy efforts. For cryogenic balances a novel axial force measurement system was developed, which solves the problem of temperature gradient induced error signals. For residual errors of this type numerical correction methods are proven. u For balance calibration a new strategy is used. A novel mathematical algorithm extracts a third order measuring

matrix (no matrix inversion necessary) from the calibration data set. In a mathematical sense this is the best possible closed solution. In cooperation with Deutsche Airbus and the Carl Schenck Company a fully automatic calibration machine was developed for ETW. A smaller and simplified version of this machine is under construction at the Darmstadt University of Technology. Finite element analysis turned out to be a powerful tool in the development of optimized balance structures. Novel balance structures with minimized linear and non-linear interference and with minimized sensitivity against temperature gradients have been developed. For half model testing, which is a more and more important technique in transport development, compact half model balances have been developed and constructed. The crucial problem of temperature sensitivity of such balances was successfully solved by FEM optimization.

Author

Cryogenic Wind Tunnels; Wind Tunnel Apparatus; Strain Gage Balances; Finite Element Method; Aerodynamic Forces; Aircraft Design

19980206009 Institute for Aerospace Research, Combustion Research Group, Ottawa, Ontario Canada

Non-Intrusive Measurement Technique for Propulsion Engines

Mulligan, M. F., Institute for Aerospace Research, Canada; MacLeod, J. D., Institute for Aerospace Research, Canada; May 1998; 12p; In English; Also announced as 19980206002; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

With financial contributions from the Canadian Department of National Defence, the Structures, Materials, and Propulsion Laboratory of the National Research Council of Canada (NRC) established a program for evaluating the effects of component deterioration on gas turbine engine performance. The effort was aimed at investigating the performance changes resulting from typical in-service faults. An important aspect of the engine test program was the use of non-intrusive sensors to supplement conventional instrumentation. Combined gas and metal thermal patterns in the infrared radiation spectra, recorded using infrared thermography, were used to evaluate gas path patterns to identify possible fault conditions. Exhaust plane thermal patterns can be classified as "healthy" for no-fault conditions, and "distressed" where known faults are in existence. Several defective engine components, including fuel nozzles, combustor cans, turbine nozzles, and thermocouple probes were used to evaluate the effectiveness of this technique on an engine test bed. This paper covers the project objectives, the experimental installation, and the results of the tests. Descriptions of the infrared thermography system, the data reduction and analysis methodology are also included.

Author

Nonintrusive Measurement; Infrared Instruments; Thermography; Engine Tests; Engine Parts; Gas Turbine Engines; Nondestructive Tests; Temperature Measurement

19980206047 Innovative Scientific Solutions, Inc., Dayton, OH USA

Application of Two-Color Digital PIV for Turbomachinery Flows

Gogineni, S., Innovative Scientific Solutions, Inc., USA; Estevadeordal, J., Innovative Scientific Solutions, Inc., USA; Sarka, B., Innovative Scientific Solutions, Inc., USA; Goss, L., Innovative Scientific Solutions, Inc., USA; Copenhaver, W., Wright Lab., USA; May 1998; 12p; In English; Also announced as 19980206002

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The potential application of a Two-Color Digital-Particle-Image-Velocimetry (DPIV) system to turbomachinery-type flows was evaluated. This system records double-exposed color images onto a single CCD sensor (3060 x 2036 pixel) and eliminates the photographic-film processing time and subsequent digitization time as well as the complexities associated with conventional image-shifting techniques. The system was calibrated using simulated known displacements and gradients and was applied to the flowfield in a 20-in.-dia. axial fan. DPIV implementation issues such as optical access, seeding strategies, and blade-passage synchronization related to turbomachinery flows were explored. Instantaneous velocity measurements were made at different span-wise locations. These measurements provided instantaneous information on the blade wake region, the flow separation off the blades, and the interaction between successive blades and also allowed a greater understanding of the impact of these phenomena on turbomachinery performance.

Author

Particle Image Velocimetry; Velocity Measurement; Unsteady Flow; Wakes; Flow Characteristics; Turbocompressors

19980206049 NASA Lewis Research Center, Cleveland, OH USA

Demonstration of PIV in a Transonic Compressor

Wernet, Mark P., NASA Lewis Research Center, USA; May 1998; 14p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Particle Imaging Velocimetry (PIV) is a powerful measurement technique which can be used as an alternative or complementary approach to Laser Doppler Velocimetry (LDV) in a wide range of research applications. PIV data are measured simultaneously at multiple points in space, which enables the investigation of the non-stationary spatial structures typically encountered in turbomachinery. Many of the same issues encountered in the application of LDV techniques to rotating machinery apply in the application of PIV. Preliminary results from the successful application of the standard 2-D PIV technique to a transonic axial compressor are presented. The lessons learned from the application of the 2-D PIV technique will serve as the basis for applying 3-component PIV techniques to turbomachinery.

Author

Particle Image Velocimetry; Transonic Compressors; Flow Velocity; Velocity Measurement; Wakes; Imagery

19980203625 Ibaraki Univ., Dept. of Mechanical Engineering, Hitachi, Japan

Angular Coordinate Repetitive Control of Magnetic Bearings

Okada, Yohji, Ibaraki Univ., Japan; Nagai, Bunshu, Ibaraki Univ., Japan; Karino, Katsuhiko, Ibaraki Univ., Japan; Fourth International Symposium on Magnetic Suspension Technology; May 1998, pp. 339-349; In English; Also announced as 19980203598; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

New repetitive control is applied to active magnetic bearings. It is intended for rotor magnetic bearing systems to reduce unbalanced response automatically. Repetitive control is a kind of servo control which is expected to follow periodic command. The follow-up property is based on internal model principles, that is, the controller includes a repetitive-type transfer function. The system also has noise rejection properties from the repetitive disturbance produced by the rotor imbalance. A simple experiment is performed to confirm the proposed technique. The results show good disturbance rejection properties and robustness.

Author

Magnetic Bearings; Servomechanisms; Rotors; Transfer Functions; Automatic Control; Servocontrol

19980206011 Defence Research Agency, Propulsion Dept., Farnborough, UK

DIAL Measurements on a Gas Turbine Exhaust

Brundish, K. D., Defence Research Agency, UK; Wilson, C. W., Defence Research Agency, UK; Moncrieff, J. T. M., Spectrasyne Ltd., UK; May 1998; 8p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

This paper summarises work undertaken by Defence Evaluation and Research Agency (DERA) and SPECTRASYN, and examines the technique of DIAL as a measurement of gas turbine engine emissions. The work was jointly funded by the UK MOD and UK DTI. The DIAL technique is based on LIDAR, which is a laser based range finding system, similar to RADAR. With the use of a tuneable laser it can be adapted for spectroscopic measurements of mass flux. This technique was used to measure NO(x) and unburnt hydrocarbon mass fluxes from the vertical engine detuner, for two engines at three running conditions. The NO(x) measurements were converted to vppm values at the engine exit plane to allow comparison with intrusive probe measurements. The DIAL measurements of NO(x) at idle and max. continuous were within 25% of the probe measurements. The DIAL measurements are performed at a plane downstream of the detuner exit, and rely on the wind to move the plume through this plane. Low wind speeds which are usually associated with variable wind directions, can result in increased uncertainty. However, minimum reheat values were considerably different, and cannot be explained by these uncertainties. This anomaly is as yet unresolved, although a possible solution may be from continued reactions in the detuner. The unburnt hydrocarbon (UHC) measurements from both DIAL and the probe exhibited the same trends, although a direct comparison was not possible due to the unknown composition of the hydrocarbons exiting the engine. This made it impossible to calculate concentration from the mass flux measurements. Further work on gas turbine engines should be performed under less arduous conditions for DIAL measurements than the reported tests. Measurements in open areas directly behind the engine with a horizontal plume, offers the best conditions.

Author

Exhaust Emission; Optical Radar; Measuring Instruments; Nitrogen Oxides; Exhaust Gases; Gas Turbine Engines; Mass Flow Rate

19980206012 Sverdrup Technology, Inc., Arnold Engineering Development Center Group, Arnold AFS, TN USA

UV Absorption Measurements of Nitric Oxide Compared to Probe Sampling Data for Measurements in a Turbine Engine Exhaust at Simulated Altitude Conditions

Howard, R. P., Sverdrup Technology, Inc., USA; May 1998; 10p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Nitric oxide measurements were conducted in the exhaust of a turbofan engine at simulated altitude conditions in a ground-level test cell using both optical nonintrusive and conventional gas sampling techniques. NO-UV absorption measurements, using

both resonance and continuum lamps, were made through several chords of the exhaust flow near the nozzle exit plane as a part of a larger effort to characterize aircraft exhaust constituents over a wide range of steady-state engine operating conditions. This paper describes the NO-UV absorption measurements and compares radial profiles of NO concentrations and emission indices with measurements obtained using conventional gas sampling and tunable diode laser infrared absorption.

Author

Ultraviolet Absorption; Absorption Spectroscopy; Nitric Oxide; Turbofan Engines; Laser Spectroscopy; Exhaust Emission; Flow Measurement

19980206015 Deutsche Gesellschaft fuer Luft- und Raumfahrt, Inst. fuer Physikalische Chemie der Verbrennung, Stuttgart, Germany

Characterization of Gas Turbine Combustion Chambers with Single Pulse CARS Thermometry

Lueckerath, R., Deutsche Gesellschaft fuer Luft- und Raumfahrt, Germany; Bergmann, V., Deutsche Gesellschaft fuer Luft- und Raumfahrt, Germany; Stricker, W., Deutsche Gesellschaft fuer Luft- und Raumfahrt, Germany; May 1998; 8p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Temperature results of three measuring campaigns with the mobile CARS system of the DLR Stuttgart are presented. The experiments were performed on different combustion chambers: a thrust nozzle test facility, a RQL combustor, and a ramjet combustor. Single pulse CARS N₂ thermometry was used to characterize the homogeneity of the flame at the exit plane of the combustion chamber, to address the quality of mixing of fuel-rich burnt gas of the primary zone with secondary air, to find an improved design for the H₂ injection into a high speed air flow, and to measure the temperature and pressure variations in the shock controlled free jet flame. In the last case both the temperature and the pressure could be determined from the CARS spectrum.

Author

Combustion Chambers; Temperature Measurement; Gas Turbine Engines; Measuring Instruments; Nonintrusive Measurement; Combustion

19980206016 Rolls-Royce Ltd., Applied Science Lab., Derby, UK

CARS Diagnostics on Model Gas Turbine Combustor Rigs

Black, John D., Rolls-Royce Ltd., UK; Wiseall, Stephen S., Rolls-Royce Ltd., UK; May 1998; 12p; In English; Also announced as 19980206002

Contract(s)/Grant(s): CEC-AERO-CT92-0036; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Rolls-Royce Applied Science Laboratory has been active in CARS (Coherent Anti-Stokes Raman Spectroscopy) thermometry in aero gas turbine related combustion rigs for over ten years. This paper describes the mobile CARS system currently used for temperature measurements on research rigs, the current limitations of the technique, and future plans for improvements and implementation.

Author

Temperature Measurement; Gas Turbine Engines; Raman Spectroscopy; Nonintrusive Measurement; Exhaust Gases; Combustion; Combustion Chambers

19980205056 New Hampshire Univ., Dept. of Mechanical Engineering, Durham, NH USA

Stress-Intensity Factors for Elliptical Cracks Emanating from Countersunk Rivet Holes *Final Report*

Gosz, M., New Hampshire Univ., USA; Moran, B., New Hampshire Univ., USA; Apr. 1998; 38p; In English Report No.(s): PB98-146186; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Small cracks developing from rivet holes in lap joints of fuselage structure have been an issue of concern over the past decade. Stress-intensity factor solutions required to assess the structural integrity of such configurations are lacking. To address this need, the domain integral method was used in their research to obtain the mode I, normalized stress-intensity factor distributions for cracks emanating from a centrally located countersunk rivet hole in a square plate subjected to remote tension.

NTIS

Cracks; Riveted Joints; Fuselages; Stress Concentration; Holes (Mechanics)

13 GEOSCIENCES

Includes geosciences (general); earth resources and remote sensing; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

19980203250 Naval Facilities Engineering Command, San Diego, CA USA

Final Environmental Impact Statement for the Realignment of E-2 Squadrons from Marine Corps Air Station (MCAS) Miramar, Volume 1 Final Report

Mar. 1998; 694p; In English

Report No.(s): AD-A341657; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

The purpose of the proposed action is to meet the legal directives of the Defense Base Closure and Realignment Act of 1990 (DBCRA) Public Law No. 101-510 to realign E-2 aircraft and facilities. The proposed action will relocate four E-2 aircraft squadrons and related support personnel, equipment, and functions from MCAS Miramar to one of three alternative naval bases in California. The proposed action includes siting 16 E-2 aircraft, relocating 988 associated personnel and their families, and expanding or constructing facilities to support aircraft and personnel, and to provide associated training functions. In addition to the increased staffing and equipment levels, there would be an increase in Navy training activities and an increase in flight operations at the receiving installation. The three installations considered for the receiving base are Naval Air Weapons Station (NAWS) Point Mugu (the preferred alternative), Naval Air Station (NAS) Lemoore, and Naval Air Facility (NAF) El Centro. NAS North Island was initially considered as a potential alternative base, but was eliminated due to the need to support Clean Air Act, as amended, 42 USA Code (USC) 7401 et seq., requirements with regard to the BRAC-mandated Marine Corps realignment to MCAS Miramar. This EIS evaluates the potential environmental impacts that may result from constructing and/or operating airfield, training, maintenance and personnel support facilities required to carry on the E-2 mission at the three alternative base locations. This EIS has been prepared in accordance with the National Environmental Policy.

DTIC

E-2 Aircraft; Flight Operations; Environment Effects

16 PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.

19980204002 Tsentralni Aerogidrodinamicheskii Inst., Zhukovsky, Russia

Application of Optical and Interference Methods in Experimental Aerodynamics

Koulech, V. P., Tsentralni Aerogidrodinamicheskii Inst., Russia; Fonov, S. D., Tsentralni Aerogidrodinamicheskii Inst., Russia; Yakovlev, V. A., Tsentralni Aerogidrodinamicheskii Inst., Russia; May 1998; 12p; In English; Also announced as 19980203985; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

The review of optical methods, which were developed and used during the last years in TsAGI for investigations of aircraft aerodynamics and aeroelasticity, is presented. Non-traditional methods of flow investigations are considered in more detail: a raster-type shadowgraph method of flow visualization, laser interferometry with a narrow reference beam, shift interferometry and laser holographic interferometry, a laser-knife method. The combination of visualization by a laser-knife method with local measurements of velocity distribution with the help of a laser Doppler velocimeter (LDV) is offered, which allows to optimize a grid of nodes of velocity measurement. To study the shape, motion and deformation of the aerodynamic models and aircraft structure elements in aerodynamic wind tunnels a number of optical, laser and videogrammetric systems ensuring high sensitivity and processing of results in real time is developed.

Author

Aerodynamics; Velocity Measurement; Velocity Distribution; Real Time Operation; Laser Interferometry; Laser Doppler Velocimeters; Holographic Interferometry; Flow Visualization

19980206019 Innovative Scientific Solutions, Inc., Beavercreek, OH USA

Optical Measurements of Surface Pressure and Temperature in Turbomachinery

Navarra, Kelly, Innovative Scientific Solutions, Inc., USA; Goss, Larry, Innovative Scientific Solutions, Inc., USA; Jordan, Jeffery, Innovative Scientific Solutions, Inc., USA; Rabe, Doug, Wright Lab., USA; Gord, Jim, Wright Lab., USA; Car, David,

Wright Lab., USA; May 1998; 14p; In English; Also announced as 19980206002; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

A new pressure-measurement technique which employs the tools of molecular spectroscopy has recently received considerable attention in the aerospace community. Measurements are made via oxygen-sensitive molecules attached to the surface of interest as a coating, or paint. The pressure-sensitive-paint (PSP) technique is now commonly used in stationary wind-tunnel tests; this paper presents extension of the technique to advanced turbomachinery applications. New pressure- and temperature-sensitive paints (TSPs) have been developed for application to a state-of-the-art transonic compressor where pressures up to 2 atm and surface temperatures to 140 C are expected for the first-stage rotor. PSP and TSP data images have been acquired from the suction surface of the first-stage rotor at 85% of the correct design speed for the compressor peak-efficiency condition. The shock structure is clearly visible in the pressure image, and visual comparison to the corresponding computer prediction shows quantitative pressures similar to the PSP data. The measurement error is estimated to range from 0.36 kPa in low pressure regions to 4 kPa in high-pressure regions. The errors were significantly increased by a failure mode of the camera which will be described.

Author

Paints; Surface Temperature; Optical Measurement; Pressure Measurement; Molecular Spectroscopy; Transonic Compressors; Wind Tunnel Tests; CCD Cameras

17 SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law, political science, and space policy; and urban technology and transportation.

19980203594 Illinois Univ., Savoy, IL USA

Aviation/Aerospace Teacher Education Workshops: Program Development and Implementation

Green, Mavis F., Illinois Univ., USA; Journal of Air Transportation World Wide; 1998; ISSN 1093-8826; Volume 3, No. 1, pp. 32-41; In English; Also announced as 19980203590; Copyright Waived (NASA); Avail: CASI; A02, Hardcopy; A02, Microfiche

This proposal is for an Aviation/Aerospace Teacher Education Workshop. The workshop will be offered to elementary school teachers. During the course of the workshop, the teachers will become familiar with aviation fundamentals and issues, and with ways to incorporate aviation topics into their normal curricula to enhance education. The proposal is organized in two parts. Part I deals with issues of program development. These issues include program intent, benefit to the sponsoring institution, program model, credibility, co-sponsorship and potential problems. Part II deals with problems specifically related to program implementation.

Author

Education; Instructors; Learning; Aeronautics

19980203597 Cranfield Univ., Bedford, UK

Trends in Airline Labor Productivity and Cost in Europe

Alamdari, Fariba, Cranfield Univ., UK; Journal of Air Transportation World Wide; 1998; ISSN 1093-8826; Volume 3, No. 1, pp. 71-88; In English; Also announced as 19980203590; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A02, Microfiche

Following the liberalization of air services in Europe in 1988 and more liberal agreements with countries outside Europe, European air carriers have come under increasing pressure to reduce costs. This has been in response to growing competition in their markets from fellow European carriers and the US airlines. Labor has been the most obvious area of costs for airlines to tackle. This paper analyzes trends in the numbers of employees, labor wages (labor costs per employee) and labor unit costs (labor expenses per available ton-kilometer) of European carriers from 1985 to 1995. Labor costs compare average take-home pay for employees, adjusted for cost-of-living differences between countries. It also compares labor pay between airline and manufacturing. The results indicate that European airlines reduced unit labor costs by increasing productivity. When taxes and social costs are deducted from the labor costs, there appears to be a large difference in take-home pay between countries. It was also found that most airlines in the sample pay their employees, on average, more than employees working in the manufacturing industry in their respective countries. The gap between the two however, was narrowing. It is recommended that incentives policies such as profit sharing or employee share ownership could become more effective in reducing real wage levels while leading to further improvements in productivity.

Author

Airline Operations; Labor; Productivity; Trends; Cost Reduction; Civil Aviation; Air Transportation; Operating Costs

19980203596 Seattle Univ., WA USA

Toward an International Open Skies Regime: Advances, Impediments, and Impacts

Toh, Rex S., Seattle Univ., USA; Journal of Air Transportation World Wide; 1998; ISSN 1093-8826; Volume 3, No. 1, pp. 61-70; In English; Also announced as 19980203590; Copyright Waived (NASA); Avail: CASI; A02, Hardcopy; A02, Microfiche

The International Air Transportation Competition Act of 1979 heralded the era of Open Skies in international aviation. This paper traces the post-war regulation and then deregulation of fares, rates, routes, and capacity all the way from Bermuda I through the partial dismantling of the International Air Transport Association (IATA) price fixing apparatus; and discusses the impediments to Open Skies and examines the impact on the IATA.

Author

Air Transportation; Competition; Control; Economic Impact; Airline Operations

19980203592 Nebraska Univ., Aviation Inst., Omaha, NE USA

Intermodal Airport-to-City-Center Passenger Transportation at the 20 Largest US Air Carrier Airports: The Past, Present, and Future

Lehrer, Henry R., Nebraska Univ., USA; Freeman, Aimee, Nebraska Univ., USA; Journal of Air Transportation World Wide; 1998; ISSN 1093-8826; Volume 3, No. 1, pp. 12-22; In English; Also announced as 19980203590; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A02, Microfiche

The 20 largest US air carrier airports handle close to 60 percent of all the passengers enplaned in the USA. While the intra-airport movement of these passengers has become more efficient in recent years, the most difficult and challenging airport-associated journey is still between the airport and the city-center. The root cause of this problem is likely due to the unexpected growth of air transportation following US airline deregulation in 1978. Most major US cities lacked a well-planned intermodal transportation infrastructure, particularly one that had an airport interface. Additionally, the automobile remains the predominant short-haul passenger transportation system in the USA. This paper presents an overview and analysis of the top 20 US air carrier airports' efforts in the past, present, and in the future to provide intermodal passenger transportation between the airport and city-center. Airport planners, developers, and management personnel in the targeted cities were surveyed concerning these issues. These data will be used to extend the knowledge-base concerning development of the US intermodal airport passenger transportation infrastructure.

Author

Air Transportation; Airline Operations; Airports; Cities; Passengers

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